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INTERRELATIONS OF DEMAND, PRICE, AND INCOME[1]

I. Introduction

THAT income, as well as price, affects the demand for a commodity is of course a truism, although the relations existing between these variables for the economy as a whole still remain to be determined. For an individual consumer, however, the interrelations of demand, income, and price are essentially at hand in the writings of Vilfredo Pareto, Eugen Slutsky, and J. R. Hicks and R. G. D. Allen; and some of these relations also hold for aggregate market phenomena. The main objectives of this paper are: (1) to develop these interrelations in a simple, logical manner; (2) to show their bearing on the theory of the demand for completing and competing goods and on the elasticity of substitution; (3) to call attention to some unsolved problems in this field; and (4) to compare the theoretical results with those yielded by the concrete, statistical demand curves of beef, pork, and mutton.

II. Definitions

In the general theory of exchange of Walras and Pareto, income is not introduced as a separate and distinct variable. The

[1] I am profoundly grateful to Mr. Milton Friedman for invaluable assistance in the theoretical and statistical investigations which underlie this study, and to Miss Anne M. Lescisin, Mr. Jacob L. Mosak, and Miss Anne Mitchell for assistance with the computations.

individual trader is assumed to come to the market with fixed quantities x_0, y_0, z_0, ... , of the n commodities (X), (Y), (Z), ... These quantities constitute his *stock in trade*, or his *wealth*, all but one of which may be zero. At the end of the exchange he has the quantities x, y, z, ... , of the same goods. The difference $(y-y_0)$ between the final and the initial quantities of any commodity (Y) may be either positive or negative. In the first case it represents the quantity demanded; and in the second, the quantity supplied.

One commodity—say, (X)—is generally taken as the standard commodity (Walras' *numéraire*), in terms of which the prices of all the other goods are expressed (but which itself has no utility other than that which arises from its ordinary properties as a commodity), so that, in Walras' notation,

$$p_x=1, \qquad p_y=p_{y\cdot x}, \qquad p_z=p_{z\cdot x}, \qquad \ldots\ldots$$

These prices are assumed to be unaffected by the individual's trading, so that his budget always balances: he gives (supplies) in proportion to what he receives (demands), and receives in proportion to what he supplies. The equation which expresses this fact is

$$(1) \qquad (x-x_0)+(y-y_0)p_y+(z-z_0)p_z+ \ldots . =0 .$$

If we write this equation in the form

$$(2) \qquad x+yp_y+zp_z+ \ldots . =x_0+y_0p_y+z_0p_z+ \ldots . ,$$

we observe that it expresses the invariance of values. Since x_0, y_0, z_0, ... , are the quantities which the individual possessed at the beginning of the exchange, the right side of equation (2) represents the sum of these quantities expressed in terms of the standard commodity, or the *value of the wealth* of the individual at the beginning of the exchange. The left side of (2) represents the value of his wealth at the end of the exchange. This equation tells us, therefore, that the wealth of the individual expressed in terms of the standard commodity must be constant, no matter what may

be the quantities of the various commodities which he buys and the prices which he pays for them.

If our trader comes to the market with only x_0 units (dollars) of (X) and with nothing of the other commodities, we represent this situation by putting $y_0 = z_0 = \ldots = 0$. The trader will then supply $(x - x_0)$ units of (X) and demand the quantities $y, z, \ldots$, of the commodities (Y), (Z), ... , at the prices which he finds in the market. Equation (2) then becomes

$$p_y y + p_z z + \ldots = x_0 - x , \tag{3}$$

which expresses the fact that the value of the goods purchased is equal to the amount spent.

This equation may also be written in a form corresponding to (2):

$$x + p_y y + p_z z + \ldots = x_0 , \tag{4}$$

which states that the value of the goods purchased, plus the unexpended balance x, is equal to the *wealth* x_0 of the individual.

The interpretation of $x_0, y_0, z_0, \ldots$ [and hence of the right side of (2) and (4)], as representing the wealth of the individual is, however, valid only for a single exchange. If, instead of thinking of these quantities as relating to a single exchange, we think of them as describing the *average* of many situations, each extending over sufficiently long periods but not involving secular changes in taste, then the quantities $x_0, y_0, z_0, \ldots$, represent the constituents of the *income stream* of the individual, and the right side of equation (2) [or of equation (4)] is equal to the *value of that income stream* in terms of the standard commodity (X). Equation (2) now reads

$$\textit{Value of goods purchased} = \textit{Value of income} . \tag{5}$$

With this interpretation, the quantity x in equations (3) and (4) no longer represents the unexpended balance, but the *savings* of the individual during the time interval in question. For the purpose of this paper we shall assume that the individual spends his entire income.

In all the preceding equations, the prices were not expressed in terms of money but in terms of a standard commodity (X). Although this is useful for many theoretical purposes, it is not convenient for our immediate needs. Let us, therefore, express our prices in terms of *money*—a commodity which has no direct utility, its importance being due solely to its use as a medium of exchange.[2] Equations (1) and (2) then become, respectively,

$$(6a) \qquad (x-x_0)p_x+(y-y_0)p_y+(z-z_0)p_z+ \ldots . =0 ,$$

and

$$(6b) \qquad r \equiv x_0p_x+y_0p_y+z_0p_z+ \ldots . = xp_x+yp_y+zp_z+ \ldots . ,$$

where r is the *money value* of the individual's income.

Although both of these equations are an expression of the same obstacle (fixed income) which the individual must overcome to satisfy his desires at the prevailing prices, they each have their peculiar advantages and limitations. The advantage of using (6b) is that it enables us to treat income as a single variable, r, thus facilitating its use in the analysis of demand. The advantage of (6a) is that it can be used to determine not only the demand curve but also the supply curve (corresponding to a fixed stock) of any commodity, since it lists the fixed stocks x_0, y_0, ... , separately and does not club them together in the variable r. In this study we shall have occasion to use both of these equations.

Equation (6a) is, of course, not sufficient to determine the quantities $(x-x_0)$, $(y-y_0)$, $(z-z_0)$, which the individual will demand or supply. To determine these unknowns we must also know his tastes or desires, i.e., his utility function. Let this function be

$$(7) \qquad \varphi=\varphi(x, y, z, \ldots .) ,$$

and let its partial derivatives with respect to x, y, ... ,

$$(8) \qquad \begin{cases} \varphi_x=\varphi_x(x, y, z, \ldots .) \\ \varphi_y=\varphi_y(x, y, z, \ldots .) \\ . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \end{cases}$$

[2] It is, of course, possible for a single commodity to be both the *numéraire* and money.

be respectively the final degrees of utility of x, y, ... We shall make the usual assumptions that

$$(9) \qquad \begin{cases} \varphi_x > 0, & \varphi_y > 0, & \dots \\ \varphi_{xx} < 0, & \varphi_{yy} < 0, & \dots \end{cases}$$

and that

$$(10) \qquad \varphi_{xy} \gtrless 0, \qquad \varphi_{xz} \gtrless 0, \qquad \varphi_{yz} \gtrless 0,$$

according as the commodities in question are completing, independent, or competing in consumption. We have, then, the well-known system of $(n-1)$ independent relations

$$(11) \qquad \frac{\varphi_x}{p_x} = \frac{\varphi_y}{p_y} = \frac{\varphi_z}{p_z} = \dots,$$

which expresses the fact that, given the obstacles which the individual must overcome, his desires or tastes are satisfied. His weighted final degrees of utility are equal to each other, the weights being the reciprocals of the prices. To divide the final degree of utility by the price is to make the unit of the commodity the "dollar's worth." These equations mean, therefore, that at the margin, the utility of a "dollar's worth" is the same for all commodities. Together with (6a) they constitute a system of n independent equations which are in general sufficient to determine the n quantities.

There is one more relation which we shall have occasion to use and which must be defined. Denote the *common equilibrium value* of φ_x/p_x, φ_y/p_y, φ_z/p_z, ... , by m:

$$(12) \qquad m = \frac{\varphi_x}{p_x} = \frac{\varphi_y}{p_y} = \frac{\varphi_z}{p_z} = \dots.$$

Then we define m as the *final utility of money expenditure*.[3] This definition makes m a function of the equilibrium prices and of the

[3] For a more detailed discussion of this concept see François Divisia, *Économique rationnelle* (Paris, 1928), pp. 416–33; and R. G. D. Allen, "On the Marginal Utility of Money and Its Application," *Economica*, XIII (1933), especially 187–94.

initial quantities (income) possessed by the individual. Since (12) is true only at equilibrium, the notion of final utility of money expenditure is an equilibrium concept, and differs, therefore, from the final utility of a direct good—a concept which has meaning under all conditions. The final utility of money should not be confused with the final utility of the cash balance (Walras' *encaisse désirée*), although the two notions are related to one another.

The foregoing definitions imply that utility is a measurable quantity, uniquely determined except for an origin and a scale constant. This assumption is necessary in order to give definite signs to the second partial derivatives of the utility function φ_{xx}, φ_{xy}, ...[4] We shall see later, however, that the more important results derived in this paper do not depend for their validity on the assumption that utility is measurable, but are invariant under the transformation of φ into any function, $F(\varphi)$, entirely arbitrary except for the condition that $F'>0$.

III. Statement of Problem

Write (12) in the symmetrical form

$$(13) \qquad \varphi_x = mp_x\,, \qquad \varphi_y = mp_y\,, \qquad \varphi_z = mp_z\,, \qquad \ldots\ldots$$

The solution of this system, together with (6a), gives, as we have seen, the equilibrium quantities $(x-x_0)$, $(y-y_0)$, $(z-z_0)$, ... , which the individual will demand or supply at the prices p_x, p_y, p_z, ... , which are assumed to be fixed.

Since his tastes (utility functions) are assumed to undergo no modification, a change in the system may be brought about either through a change in the prices or through a change in his income, r.

If the price p_y should change to p_y', the new situation will be

[4] See Vilfredo Pareto, *Manuel d'économie politique* (Paris, 1909), pp. 545–46; O. Lange, "The Determinateness of the Utility Function," *Review of Economic Studies*, I (1934), 218–25; E. H. Phelps Brown, H. Bernardelli, and O. Lange, "Notes on the Determinateness of the Utility Function," *ibid.*, II (1934), 66–77; and R. G. D. Allen, "A Note on the Determinateness of the Utility Function," *ibid.*, II (1935), 155–58.

given by the same equations (6a) and (13) in which, however, p_y will be replaced by p'_y. Solving these equations, we get a new series of values $(x-x_0)$, $(y-y_0)$, ... , for the quantities demanded and supplied. Proceeding in this manner, we can obtain the effect of a given change in p_y on the final utility of money (m), on the quantity $(y-y_0)$ of the commodity in question (Y) that will be demanded or supplied, and on the quantity $(x-x_0)$ of any other commodity (X) that will be demanded or supplied. Similarly, if the income r should change to r', we can obtain the effect that this would have on the same variables.

What we desire to know, however, is whether it is possible to derive the desired results without having to undertake the exceedingly laborious and practically impossible task of solving the set of equations every time there is a change in the price p_y or in the income r. More specifically, our problem is this: Suppose that the price p_y of (Y) is increased by dp_y, or that the income r is increased by dr. What values must the partial derivatives

$$\frac{\partial m}{\partial p_y}, \quad \frac{\partial_x}{\partial p_y}, \quad \frac{\partial y}{\partial p_y}, \quad \ldots,$$

$$\frac{\partial m}{\partial r}, \quad \frac{\partial x}{\partial r}, \quad \frac{\partial y}{\partial r}, \quad \ldots,$$

have and what relationships must subsist among them in order that equations (6a) and (11) [or (6b) and (11)] shall be satisfied?

IV. Solution

The solution of this problem was first given by Pareto in 1892,[5] but was simplified, extended, and put in more elegant form by Professor Eugen Slutsky, the Russian statistician and economist,

[5] "Considerazioni sui principii fondamentali dell'economia pura," *Giornale degli economisti*, 2d ser., IV (1892), 389–420; *ibid.*, V (1892), 119–57; *ibid.*, VI (1893), 1–37; *ibid.*, VII (1893), 279–321; *Cours d'économie politique* (Lausanne, 1896), Vol. II, § 977; *Manuel d'économie politique* (Paris, 1909), Appendix, §§ 52–62, 579–91; and "Économie mathématique," *Encyclopédie des sciences mathématiques*, Tome I, Vol. IV, Fascicule 4 (1911), §§ 32–36.

in a remarkable paper in 1915.[6] Following Slutsky's general procedure, but deviating as little as possible from Pareto's symbolism, since his works are more easily accessible, we may give the solution in three steps: (1) the variation of demand with price, (2) the variation of demand with income, and (3) the interrelations of demand, price, and income.

A. VARIATION OF DEMAND (OR SUPPLY) WITH PRICE

Differentiate (6a) and (13) with respect to p_y, remembering that the prices are independent variables. This gives the following set of $(n+1)$ equations:

$$(14)\quad \begin{cases} -(y-y_0) = \quad 0 \quad + p_x \dfrac{\partial x}{\partial p_y} + p_y \dfrac{\partial y}{\partial p_y} + p_z \dfrac{\partial z}{\partial p_y} + \cdots \\ \quad 0 \quad = -p_x \dfrac{\partial m}{\partial p_y} + \varphi_{xx} \dfrac{\partial x}{\partial p_y} + \varphi_{xy} \dfrac{\partial y}{\partial p_y} + \varphi_{xz} \dfrac{\partial z}{\partial p_y} + \cdots \\ \quad m \quad = -p_y \dfrac{\partial m}{\partial p_y} + \varphi_{xy} \dfrac{\partial x}{\partial p_y} + \varphi_{yy} \dfrac{\partial y}{\partial p_y} + \varphi_{yz} \dfrac{\partial z}{\partial p_y} + \cdots \\ \quad 0 \quad = -p_z \dfrac{\partial m}{\partial p_y} + \varphi_{xz} \dfrac{\partial x}{\partial p_y} + \varphi_{yz} \dfrac{\partial y}{\partial p_y} + \varphi_{zz} \dfrac{\partial z}{\partial p_y} + \cdots \\ \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots \end{cases}$$

from which to determine the $(n+1)$ unknown partial derivatives: $\partial m/\partial p_y$, $\partial x/\partial p_y$, $\partial y/\partial p_y$, ...

Let M be the determinant of (14):

$$(15)\qquad M = -\begin{vmatrix} 0 & p_x & p_y & p_z & \cdots \\ p_x & \varphi_{xx} & \varphi_{xy} & \varphi_{xz} & \cdots \\ p_y & \varphi_{xy} & \varphi_{yy} & \varphi_{yz} & \cdots \\ p_z & \varphi_{xz} & \varphi_{yz} & \varphi_{zz} & \cdots \\ \cdots & \cdots & \cdots & \cdots & \cdots \end{vmatrix}$$

and let M_{ij} be the cofactor corresponding to the element of the ith row and the jth column of M, M_{ij} being equal to M_{ji} on

[6] Eugen Slutsky, "Sulla teoria del bilancio del consumatore," *Giornale degli economisti*, LI (1915), 1–26.

account of the symmetry of M. The solution of the simultaneous equations may then be written in the following simple form:

$$\frac{\partial m}{\partial p_y}=\frac{(y-y_0)M_{11}-mM_{31}}{M}, \tag{16}$$

$$\frac{\partial x}{\partial p_y}=\frac{-(y-y_0)M_{12}+mM_{32}}{M}, \tag{17}$$

$$\frac{\partial y}{\partial p_y}=\frac{-(y-y_0)M_{13}+mM_{33}}{M}. \tag{18}$$

These equations are analogous to the equations (74), (75), and (76) given on page 581 of Pareto's *Manuel*.

Interest naturally centers on the differential equation (18), which expresses the rate of change of the individual's demand (or supply) for (Y) with respect to its price, as a function of all the prices, all the initial quantities (income), and all the marginal utility functions. If we solve this equation, we obtain

$$y=f_y(p_y, p_z, \ldots, x_0, y_0, \ldots), \tag{19}$$

which is the general demand function of the individual. Adding the quantities demanded by all the individuals in the market, we get

$$\sum y=Y=f_Y(p_y, p_z \ldots, R), \tag{20}$$

which is the general market demand function for (Y). In this equation R is a function of the constants $x_0, y_0, \ldots$, and represents the size and the distribution of the income of the economy.[7] The individual incomes are the initial conditions which determine the constants of integration.

[7] In practice the process of obtaining the market demand function from the individual demand function of the type (18) would be complicated by the difficulty of giving a clear, unambiguous definition of "social income," for this need not equal the sum of the nominal incomes of the individuals.

B. VARIATION OF DEMAND WITH INCOME

In obtaining equations (16), (17), and (18) we used equation (6a), in which the income of the individual is expressed in terms of the quantities of the various commodities in his possession at the beginning of the exchange process. As we shall see later, this procedure enables us to study the effect of a change in the price of a given commodity on the quantity of it that is supplied, as well as on the quantity that is demanded. In analyzing the effect of a change in income on demand, it is, however, more convenient to express income in terms of money, and use (6b) rather than (6a). Thus, differentiating (6b) and (13) with respect to r, and remembering that the market prices are assumed to be unaffected by changes in the individual's income, we obtain the following set of $(n+1)$ simultaneous equations:

$$(21)\qquad \begin{cases} 1 = 0 \quad + p_x \dfrac{\partial x}{\partial r} + p_y \dfrac{\partial y}{\partial r} + p_z \dfrac{\partial z}{\partial r} + \cdots \\ 0 = -p_x \dfrac{\partial m}{\partial r} + \varphi_{xx} \dfrac{\partial x}{\partial r} + \varphi_{xy} \dfrac{\partial y}{\partial r} + \varphi_{xz} \dfrac{\partial z}{\partial r} + \cdots \\ 0 = -p_y \dfrac{\partial m}{\partial r} + \varphi_{xy} \dfrac{\partial x}{\partial r} + \varphi_{yy} \dfrac{\partial y}{\partial r} + \varphi_{yz} \dfrac{\partial z}{\partial r} + \cdots \\ 0 = -p_z \dfrac{\partial m}{\partial r} + \varphi_{xz} \dfrac{\partial x}{\partial r} + \varphi_{yz} \dfrac{\partial y}{\partial r} + \varphi_{zz} \dfrac{\partial z}{\partial r} + \cdots \\ \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \end{cases}$$

from which to determine the (n+1) unknown partial derivatives $\partial m/\partial r$, $\partial x/\partial r$, $\partial y/\partial r$, ...

The determinant of (21) is the same as that of (14), and is given by (15). In terms of this determinant, M, the solution is

$$(22)\qquad \frac{\partial m}{\partial r} = -\frac{M_{11}}{M},$$

$$(23)\qquad \frac{\partial x}{\partial r} = \frac{M_{12}}{M},$$

$$(24)\qquad \frac{\partial y}{\partial r} = \frac{M_{13}}{M}.$$

C. VARIATION OF DEMAND WITH PRICE AND INCOME

If we re-write equations (16), (17), and (18) in the form they would take if the individual's income were considered as exclusively monetary (i.e., if we set $y_0=0$ in those equations), and make use of the results just obtained, we have,

$$\frac{\partial m}{\partial p_v}=-m\frac{\partial y}{\partial r}-y\frac{\partial m}{\partial r}, \tag{25}$$

$$\frac{\partial x}{\partial p_v}=\quad m\frac{M_{33}}{M}-y\frac{\partial x}{\partial r}, \tag{26}$$

$$\frac{\partial y}{\partial p_v}=\quad m\frac{M_{33}}{M}-y\frac{\partial y}{\partial r}. \tag{27}$$

Equations (23), (24), (26), and (27) can all be proved to be invariant under the transformation of φ into $F(\varphi)$, i.e., they are independent of the assumption that utility is uniquely measurable.[8] Equations corresponding to (22) to (27) are not to be found in Pareto; they are due to Slutsky.

The interrelations of the several variables which enter into these equations are expressed in terms of absolute changes and involve, therefore, the units in terms of which the variables happen to be measured. We may, however, write these equations in a form which is independent of the units of measurement, by making use of the notion of the "elasticity" of one variable (say, α) with respect to another related variable (say, β), which has been defined as the ratio of the relative change in α to the relative change in β, with which it is associated, when the changes are infinitesimal. In symbols,

$$\eta_{\alpha\beta}=\frac{\partial\alpha}{\partial\beta}\cdot\frac{\beta}{\alpha}. \tag{28}$$

[8] The invariance is suggested by the fact that equation (6b) and the $(n-1)$ equations which can be obtained from (13) by eliminating m are all invariant under the transformation.

Expressing (25), (26), and (27) in terms of elasticities, and simplifying, we obtain

$$\eta_{mp_y} = -k_y(\eta_{yr} + \eta_{mr}) , \tag{29}$$

$$\eta_{xp_y} = m\frac{M_{32}}{M} \cdot \frac{p_y}{x} - k_y\eta_{xr} , \tag{30}$$

$$\eta_{yp_y} = m\frac{M_{33}}{M} \cdot \frac{p_y}{y} - k_y\eta_{yr} , \tag{31}$$

where $k_y = yp_y/r$ is the proportion of the total income which the individual spends on y.

Equations (25), (26), and (27) give respectively the change in the final utility of money, m, and in the quantities x and y demanded that would result from a *unit* change in the price p_y of (Y), if the other prices and the money income of the individual were kept fixed. When multiplied by dp_y, they give the *total* change in m, x, and y that would result from a change dp_y in the price p_y.

The right-hand member of each of these equations indicates that the change in the variable in question brought about by the change dp_y in the price p_y may be considered as composed of two parts. The first of these, which is measured by the first term of the right-hand member of the equation, is the change in the variable in question that would result if the price change dp_y were accompanied by such a compensating adjustment of money income as to keep real income apparently unchanged.[9] The second part, measured by the second term of the right-hand member of

[9] By the "real income of an individual" I mean the utility which he derives from the combination of economic goods and services which he consumes during a given interval of time. Two combinations represent the same real income and are said to be *equivalent* if they lie on the same indifference curve. The money income which leaves the real income of an individual *actually* unchanged in a new price situation is such as will induce him to buy a combination of goods which he considers *equivalent* to the original. The money income which leaves the real income of an individual *apparently* unchanged in a new price situation may be defined as one which enables him to buy *the identical* combination of goods as the original. The apparent money income minus the original money income may be called the *apparent loss or gain*, according as it is positive or negative.

the equation, gives the additional change in the variable which arises from the fact that money income is not so adjusted, but is held constant.

The apparent change in the real income of the individual which would arise from an (inverse) change dp_y in price is given by $dr = y dp_y$, for if this amount is added (algebraically) to his money income he will be able to buy the same quantities of the various commodities at the new set of prices as he had at the old. (Such a combination of an income change $y dp_y$ with a price change dp_y may be designated "a compensated variation of price.") It is evident, however, that although he is able to do so, the individual will not, in fact, buy the same quantities as he had previously, for the fall (or rise) in the price of (Y) modifies the price ratios, and under these conditions he will find it to his advantage to increase (or decrease) his purchases of (Y) at the expense of the other commodities.[10] Now $m \frac{M_{33}}{M} dp_y$ is the change in the quantity of (Y) demanded corresponding to the compensated variation dp_y.[11] (This change is always negative for a rise in price, and positive for a fall.)[12] Similarly, $m \frac{M_{32}}{M} dp_y$ and $-m \frac{\partial y}{\partial r} dp_y$ are, respectively, the changes in the quantity of any other commodity (X) demanded and in the final utility of money corresponding to the compensated variation dp_y in the price of (Y). These quantities may be called the "direct changes" in demand.

[10] It can be shown that by following this procedure he will land on a higher indifference curve, i.e., he will enjoy a greater utility.

[11] The proof is as follows:

When p_y and r are both allowed to change, then

$$dy = \frac{\partial y}{\partial p_y} dp_y + \frac{\partial y}{\partial r} dr .$$

In the case of a compensated variation in price, $dr = y dp_y$. Substituting this in the equation just written, and at the same time substituting for $\partial y / \partial p_y$ its value from (27), we obtain:

$$dy = \left(m \frac{M_{33}}{M} - y \frac{\partial y}{\partial r} \right) dp_y + y \frac{\partial y}{\partial r} dp_y = m \frac{M_{33}}{M} dp_y .$$

See Slutsky, *op. cit.*, p. 14.

[12] See Slutsky, *op. cit.*, p. 13, for a proof of this statement.

The remainder of the total change in each of the variables m, x, and y resulting from a change dp_y in p_y—we may call this the "indirect change"—must be attributed to the apparent gain or loss $dr = y dp_y$ in the real income. The residual change in m, x, and y corresponding to a price change dp_y is given respectively by $-\frac{\partial m}{\partial r}(y dp_y)$, $-\frac{\partial x}{\partial r}(y dp_y)$, and $-\frac{\partial y}{\partial r}(y dp_y)$, i.e., by the second terms of (25), (26), and (27) when these equations are multiplied by dp_y.[13]

If we multiply $m\frac{M_{31}}{M}$ by $\frac{p_y}{y}$, the resultant expression, which is the first term of the right-hand member of (31), is the elasticity of the demand for (Y) with respect to a compensated variation in the price of (Y). Similarly, the first terms in the right-hand members of (30) and (29)—$m\frac{M_{32}}{M}\cdot\frac{p_y}{x}$ and $-k_y\eta_{yr}$—give, respectively, the elasticity of demand of any other commodity (X) and the elasticity of the final utility of money, m, with respect to a compensated variation in the price of (Y). The second terms of (29), (30), and (31), involving as they do the elasticities of the variables with respect to income, measure the effect on these variables of the apparent change in real income.

D. ELASTICITY OF DEMAND AND ELASTICITY OF SUBSTITUTION

The important conclusions just presented were first derived by Slutsky[14] but have since been reached independently by Hicks

[13] That $-\frac{\partial y}{\partial r}(y dp_y)$ gives the change to be attributed to the apparent gain or loss in real income follows from the fact that $\frac{\partial y}{\partial r} dr$ measures the change in the quantity of (Y) purchased corresponding to a change dr in income; and in the situation here considered, $dr = -y dp_y$. The reason why dr is here the negative of what it was in n. 11 is that there we were varying income from its original value to the value that would compensate the variation in price, whereas here we are proceeding from this adjusted income to the original one.

[14] In his words: "If price increases by dp_y, the value $y dp_y$ can be said to be an *apparent loss*, since, in order to make possible the purchase of the same quantities of all the goods that had formerly been bought, the income should have to increase by $dr = y dp_y$. But the individual, though having the possibility of preserving unchanged the preceding budgetary equation [*bilancio*], will no longer consider it

and Allen in a very important paper. These writers do not, however, employ the concept of the elasticity of demand with respect to a compensated variation in price. They introduce, instead, the analogous notion of the elasticity of substitution. The Hicks-Allen elasticity of substitution between (Y) and the pair (X, Z) is equal to the negative of $1/1-k_y$ times the elasticity of demand for (Y) with respect to a compensated variation in the price of (Y). Similarly, their elasticity of complementarity of (X) with (Y) against (Z) is equal to the negative of $1/k_y$ times the elasticity of demand for (X) with respect to a compensated variation in the price of (Y). Hicks and Allen do not explicitly define the elasticities of substitution and complementarity for more than three variables. These concepts enable them to state the economic significance of (30) and (31) in these words:

> The increase in demand for a commodity (Y) which results from a fall in its price . . . . [can be looked upon] as consisting of two parts, one of which is due to the increase in the real income which a fall in the price of (Y) entails, the other to the opportunity of substituting (Y) for other goods which results from the fall in the *relative* price of (Y).[15]

E. GRAPHICAL ILLUSTRATION

The interrelations of demand, price, and income deduced above lend themselves to a simple graphical illustration if we assume that the individual consumes only two commodities, (X) and (Y); for then his system of choices may be represented by a two-

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preferable to any other, and there will take place some kind of . . . . variations of demand. . . . .

"The increment $d\dot{p}_y$ of price, accompanied by an increment of income equal to the apparent loss, can be said to be the *compensated variation* of price. In such a case $m\frac{M_{33}}{M}$ and $m\frac{M_{32}}{M}$ can be regarded as . . . . variations of demand for each unit of the compensated variation of price . . . ." (Slutsky, *op. cit.*, p. 14. I have taken the liberty of modifying Slutsky's symbols).

[15] J. R. Hicks and R. G. D. Allen, "A Reconsideration of the Theory of Value," *Economica*, XIV (1934), 66. I have taken the liberty of substituting Y for X. (Italics are theirs.)

Equations (29) and (30) correspond to the Hicks-Allen equations (16) as given on p. 209 of their article. In their paper, however, price elasticity is taken as opposite in sign to the elasticity used above, although income elasticity is defined the same way as above.

dimensional indifference map and his budget equation by the straight line

$$xp_x+yp_y=r\ .$$

If we write this equation in the intercept form:

$$\frac{x}{r/p_x}+\frac{y}{r/p_y}=1\ ,$$

we see at once that the value of x when $y=0$, or r/p_x, is the number of units of (X) that can be bought with the total income, r; and that, similarly, r/p_y is the number of units of (Y) that can be bought with the same total income. Writing the equation in the slope-intercept form:

$$y=\frac{r}{p_y}-\frac{p_x}{p_y}x\ ,$$

we also observe that the slope of the line measures the ratio of $p_x:p_y$.

In Figure 1, let t_1T_1 represent the budget line. The money income of the individual is then proportional to OT_1, and the prices p_x and p_y are in the ratio of $Ot_1:OT_1$. His equilibrium position is then given by C_1, the point at which the budget line t_1T_1 is tangent to the indifference curve I_1. At this point he demands x_1 units of (X) and y_1 units of (Y).

Now, while keeping r and p_x fixed, let us decrease the price of y from p_y to p'_y, so that $p'_y=p_y+dp_y$. Graphically, this is done by pivoting the line t_1T_1 on the point T_1 and turning it clockwise until it intersects the Y-axis at a point t'_1 such that $\frac{Ot'_1}{Ot_1}=\frac{p_y}{p_y+dp_y}$. By decreasing the price of (Y) by this amount, we increase the ratio of the price of (X) to the price of (Y) from $\frac{Ot_1}{OT_1}$ to $\frac{Ot'_1}{OT_1}$. Under the new conditions the individual finds it to his advantage to shift his position from C_1 to C_3, the point at which the line t'_1T_1 is tangent to the indifference curve I_3. The quantity of (Y)

which he demands in the new equilibrium position is increased by $y_3 - y_1 = \frac{\partial y}{\partial p_y} dp_y$, and the quantity of (X) by $x_3 - x_1 = \frac{\partial x}{\partial p_y} dp_y$.[16]

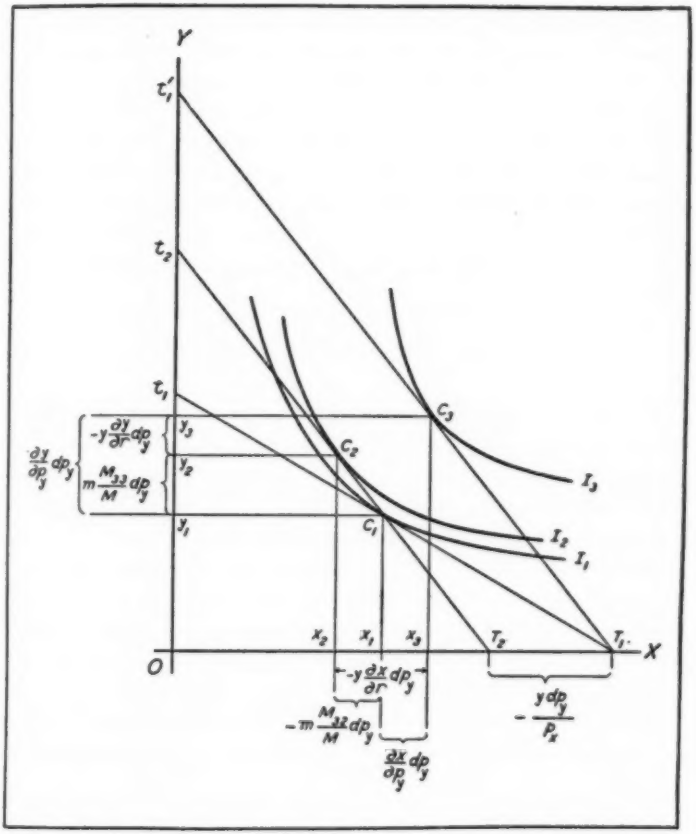

FIG. 1.—Interrelations of demand, price, and income: An illustration of the economic meaning of equations (26) and (27) in the case of two commodities.

In equations (26) and (27), the movement from C_1 to C_3 is considered as taking place in two steps: (1) that from C_1 to C_2,

[16] It is possible for one, but not both, of these quantities to be negative.

and (2) that from C_2 to C_3. The first shows what the change in the individual's equilibrium position would be if the increase in his real income arising from the reduction in the price of (Y) were offset by a compensating reduction of $-ydp_y = T_1T_2 \cdot p_x$ in his money income. Graphically, the new position of equilibrium is found by moving the line $t_1'T_1$ parallel to itself until it intersects C_1, the original equilibrium position, and determining the point C_2 at which this line is tangent to another indifference curve I_2. The transformation of the line t_1T_1 into the line t_2T_2 represents "a compensated variation in price," and the point C_2 the equilibrium position corresponding to such a variation. At this point the individual would demand y_2 units of (Y), and x_2 units of (X). His demand for (Y), whose price has fallen, would increase by $y_2 - y_1 = m\frac{M_{33}}{M}dp_y$ units; and his demand for (X), whose price, though fixed in absolute value, has risen relatively to that of (Y), would decrease by $x_1 - x_2 = -m\frac{M_{32}}{M}dp_y$ units. These are the quantities which we have called "direct changes" in demand. They are the changes in the consumption of (Y) and (X) which would result from a change of dp_y in the price of (Y), if the real income of the individual were kept apparently unchanged.

Since, however, the individual experiences in fact no compensating reduction in his money income when the price of (Y) is reduced, his real income rises. He will not, therefore, remain at C_2; he will move to C_3. The increase in the quantity of (Y) demanded as a result of this change is $y_3 - y_2 = -y\frac{\partial y}{\partial r}dp_y$, and the corresponding increase in the quantity of (X) demanded is $-y\frac{\partial x}{\partial r}dp_y$. These are the quantities which we have called "indirect changes" in demand.[17]

The total change in the demand for (Y) corresponding to the change of dp_y in p_y is, then,

$$(y_3 - y_1) = (y_3 - y_2) + (y_2 - y_1),$$

[17] It is possible for one, but not both, of these quantities to be negative.

and the corresponding total change in the demand for (X) is

$$(x_2-x_1)=(x_3-x_2)+(x_2-x_1)\ .$$

These equations constitute a geometrical translation of (27) and (26).

F. SPECIAL CASES

To get more information from (16) to (18) and (22) to (24), it is convenient to consider separately: (1) the demand for independent commodities, (2) the demand for dependent commodities, and (3) the demand for one of a large number of independent commodities.[18]

1. INDEPENDENT COMMODITIES

In this case

$$\varphi_{xy}=0\ ,\qquad \varphi_{xz}=0\ ,\qquad \ldots\ ,\qquad \varphi_{yz}=0\ ,\qquad \ldots\ ,$$

and the formulas (16), (17), (18), and (22), (23), (24), take the simpler form

$$\frac{\partial m}{\partial p_y}=-\frac{(y-y_0)+m\,\frac{p_y}{\varphi_{yy}}}{T}=-\frac{(y-y_0)+\frac{\varphi_y}{\varphi_{yy}}}{T}\ , \tag{32}$$

$$\frac{\partial x}{\partial p_y}=\frac{\partial m}{\partial p_y}\cdot\frac{p_x}{\varphi_{xx}}\ , \tag{33}$$

$$\frac{\partial y}{\partial p_y}=\frac{-(y-y_0)p_y+m\left(T-\frac{p_y^2}{\varphi_{yy}}\right)}{T\varphi_{yy}}\ , \tag{34}$$

$$\frac{\partial m}{\partial r}=\frac{1}{T}\ , \tag{35}$$

$$\frac{\partial x}{\partial r}=\frac{p_x}{T\varphi_{xx}}\ , \tag{36}$$

[18] It should be borne in mind that the definitions of independent and dependent commodities which are here used depend for their validity on the assumption previously pointed out, namely, that utility is measurable. See p. 438.

and

$$\frac{\partial y}{\partial r}=\frac{p_y}{T\varphi_{yy}}, \tag{37}$$

where

$$T=-\frac{M}{M_{11}}=\frac{p_x^2}{\varphi_{xx}}+\frac{p_y^2}{\varphi_{yy}}+\cdots\cdots$$

We also have

$$\frac{\partial[p_y(y-y_0)]}{\partial p_y}=-\frac{\partial m}{\partial p_y}\left(T-\frac{p_y^2}{\varphi_{yy}}\right), \tag{38}$$

the multiplier of $\partial m/\partial p_y$ being negative, since T is negative and numerically greater than p_y^2/φ_{yy}.

We must distinguish between demand and supply.

a) Variations of demand with price.—From these equations we draw the following conclusions:

1. When the commodity (Y) is demanded, we always have

$$\frac{\partial y}{\partial p_y}<0,$$

or the quantity demanded decreases when price increases.

This follows from (34). The prices, p_x, p_y, p_z, ... , are essentially positive. Also, $(y-y_0)>0$, since (Y) is demanded. The quantity $m=\varphi_x p_x$, and the functions φ_y, φ_z, ... , which are the first derivatives of the total utility function, are also essentially positive. The functions φ_{xx}, φ_{yy}, φ_{zz}, ... , however, are always negative by the principle of diminishing final utility. Lastly, T is negative, since φ_{xx}, φ_{yy}, φ_{zz}, ... , are negative. Hence $\partial y/\partial p_y<0$.

2. The sign of $\partial m/\partial p_y$ cannot be determined, since its numerator consists of a positive term and a negative term. It is evident from (38), however, that $\partial m/\partial p_y$ and $\frac{\partial[p_y(y-y_0)]}{\partial p_y}$ have the same sign. This last expression gives the rate of change in the individual's expenditure for (Y), as a function of p_y. (It would measure the rate of change in the *receipts* for (Y) if that commodity were

supplied.) It follows, therefore, that the index of the final utility of money will increase, remain constant, or decrease, according as the individual increases, maintains constant, or decreases his rate of expenditure for (Y).[19] Another, and perhaps more significant, statement of this proposition is that an increase in the price of (Y) is compatible with any one of the following conditions: (a) an increase in the final utility of money and an increase in the consumer outlay on (Y); (b) an unchanged final utility of money and an unchanged consumer outlay on (Y); and (c) a decrease in the final utility of money and a decrease in the consumer outlay on (Y).

b) Variations of supply with price.—For supply, the conclusions are not so positive. They may be stated as follows:

1. When the commodity (Y) is supplied, nothing can be said about the sign of $\partial y/\partial p_y$. This quantity may increase, and then decrease, passing through zero.

It should be borne in mind, however, that the supply function considered here is that which arises when the total stock of the commodity is fixed. The property of the supply function which has just been indicated is not, therefore, to be understood as holding in the normal case where the stock of the commodity can be varied by production.

2. When (Y) is supplied, we always have

$$\frac{\partial m}{\partial p_y}<0\,, \qquad \frac{\partial z}{\partial p_y}>0\,, \qquad \frac{\partial[p_y(y-y_0)]}{\partial p_y}<0\,.$$

c) Variations of demand with income.—From equations (35), (36), and (37) it follows that:

$$\frac{\partial m}{\partial r}<0\,, \qquad \frac{\partial x}{\partial r}>0\,, \qquad \frac{\partial y}{\partial r}>0\,.$$

[19] A rate of expenditure which remains constant while price changes implies unitary elasticity of demand:

$$\eta=\frac{\partial y}{\partial p_y}\cdot\frac{p_y}{y}=-1\,.$$

But a constant rate of expenditure is implied by a constant final utility of money. Hence $\partial m/\partial p_y=0$ involves unitary elasticity of demand.

The last two inequalities mean that when the commodities are independent in consumption an increase in income always brings about an increase in the quantity purchased of each commodity. It follows that the final utility of money must decrease, which is the meaning of the first inequality.

2. DEPENDENT COMMODITIES

In this case $\varphi_{yz} \gtrless 0$, depending upon whether the commodities (Y) and (Z) are completing or competing.

When the commodities are *completing*, $\varphi_{yz} > 0$; and the conclusions are the same as for independent goods.

When the commodities are *competing*, $\varphi_{yz} < 0$; and the conclusions change. *When* (Y) *is demanded, the quantity* y *may increase with* p_y, *or the demand curve may be positively inclined.* The economic explanation of this fact is that, when the goods are competing, an increase in income may bring about a *decrease* in the consumption of (Y), so that, when there is a fall in the price of this commodity, the decrease in the quantity of it demanded due to the apparent rise in real income may be greater than the increase due to the compensated fall in price. Mathematically, this means that the positive second term of the right-hand member of (27) may be greater in absolute value than the negative first term, yielding a positive value for the left-hand member, the slope of the demand curve.

3. A LARGE NUMBER OF INDEPENDENT COMMODITIES

When we have a large number of commodities whose consumptions are independent of one another, the quantity T in equations (32) to (37) may have a very large absolute value while none of its terms may be very large. We may then assume that T approaches $-\infty$ as the number of commodities increases, and thus consider the final utility of money m as approximately constant, so that $\partial m/\partial p_y$ and $\partial m/\partial r$ equal zero. The hypothesis that T is $-\infty$ has the important advantage of introducing a great simplification into the equations (33), (36), and (37), for $\partial x/\partial p_y$, $\partial z/\partial p_y$, ... , $\partial x/\partial r$, $\partial y/\partial r$, ... , may then be neglected; and equation (34) becomes

$$\frac{\partial y}{\partial p_y} = \frac{m}{\varphi_{yy}}. \tag{39}$$

As is well known, this assumption is the keystone of Marshall's theory of demand.

V. New Conditions on Demand Functions

In a previous study[20] I developed a theory of demand for completing and competing goods which yielded certain conditions which demand functions must satisfy. These are that for each pair of commodities (X) and (Y)

$$\frac{\partial p_x}{\partial y}=\frac{\partial p_y}{\partial x}, \tag{40}$$

where

$$\begin{cases} p_x=p_x(x, y, \ldots.) \\ p_y=p_y(x, y, \ldots.) \\ \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \end{cases} \tag{41}$$

are the demand functions. According to this theory, when the terms of (40) are positive, the commodities are completing in consumption; and when they are negative, the commodities are competing. Thus, if the demand functions are linear:

$$\begin{cases} p_x=b_1+b_{11}x_1+b_{12}x_2+ \ldots. \\ p_y=b_2+b_{21}x_1+b_{22}x_2+ \ldots. \\ \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \end{cases} \tag{42}$$

the condition (40) yields

$$b_{12}=b_{21}. \tag{43}$$

When the terms of (43) are positive, the commodities are completing; and when they are negative, the commodities are competing.

If we multiply and divide the first member of (40) by y/p_x and the second member by x/p_y, we obtain an expression for (40) in terms of elasticities:

$$p_x x\eta_{p_x y}=p_y y\eta_{p_y x}, \tag{44a}$$

[20] "Interrelations of Demand," *Journal of Political Economy*, XLI (1933), 468–512.

which, when divided by

$$r = p_x x + p_y y + p_z z + \ldots ,$$

yields

$$k_x \eta_{p_x y} = k_y \eta_{p_y x} .^{21} \tag{44b}$$

Furthermore, it can be shown that if (40) holds, then we must also have

$$\frac{\partial x}{\partial p_y} = \frac{\partial y}{\partial p_x} , \tag{45}$$

where

$$\begin{cases} x = x(p_x, p_y, \ldots .) \\ y = y(p_x, p_y, \ldots .) \\ . \quad . \quad . \quad . \quad . \quad . \end{cases} \tag{46}$$

are the demand functions obtained by transformation from (41). If, for example, the demand functions (46) are linear:

$$\begin{cases} x = c_1 + c_{11} p_x + c_{12} p_y + \ldots . \\ y = c_2 + c_{21} p_x + c_{22} p_y + \ldots . \\ . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad , \end{cases} \tag{47}$$

condition (45) becomes

$$c_{12} = c_{21} . \tag{48}$$

When these are negative, the commodities are completing; and when these are positive, the commodities are competing.

In terms of elasticities, conditions (45) become

$$p_x x \eta_{x p_y} = p_y y \eta_{y p_x} , \tag{49a}$$

or

$$k_x \eta_{x p_y} = k_y \eta_{y p_x} . \tag{49b}$$

[21] These elasticities correspond to what Professor H. L. Moore has called "price flexibilities." They are not necessarily the reciprocals of the ordinary elasticities of demand.

Conditions (40) and (45) follow from the Edgeworth-Fisher-Pareto definition of complementarity, namely, that two commodities, (X) and (Y), are completing, independent, or competing in consumption, according as

$$\varphi_{xy} \gtreqless 0 \text{ ,}^{22} \tag{50}$$

and from the special assumption that the final utility of money expenditure, is

$$m = constant. \tag{51}$$

They were first deduced by Professor Harold Hotelling, although he followed a procedure quite different from that suggested above.[23] I propose, therefore, to refer to (40) and (45) as the Hotelling integrability conditions.

Although conditions (40) [or (45)] are approximately satisfied by several concrete, statistical demand analyses,[24] they rest on weak foundations. The definition (50) implies[25] that utility is a measurable quantity, uniquely determined except for a scale constant and an origin (zero point); for it is only by making this assumption that we can give definite signs to φ_{xy}, φ_{xx}, ... The assumption (51) is generally valid only if the individual spends but a small proportion of his income on the commodities in question. The theory developed in Section IV and summarized in equations (26), (27), (30), and (31) is free from these limitations,[26]

[22] As I explained in my "Interrelations of Demand," definition (50) means that two commodities are completing, independent, or competing, according as an increase in the quantity of one of them augments, maintains constant, or diminishes the final utility of the other.

[23] See Harold Hotelling, "Edgeworth's Taxation Paradox and the Nature of Demand and Supply Functions," *Journal of Political Economy*, XL (1932), 577 ff.; and my "Interrelations of Demand," especially pp. 474–81.

[24] I have in mind the analyses of the demands for barley, corn, hay, and oats detailed in my "Interrelations of Demand," as well as the statistical analyses of the Canadian demand for sugar, tea, and coffee; and of the British demand for home-produced and imported mutton and lamb, which have not yet been published.

[25] See p. 438 above, and the references given in n. 4.

[26] Equations (25) and (29) are, of course, not invariant under the transformation of φ into $F(\varphi)$. But these are of little consequence in the study of demand.

and yields general conditions on the demand functions of which (40) is a special case.

Consider:

$$\frac{\partial x}{\partial p_y} = m\frac{M_{32}}{M} - y\frac{\partial x}{\partial r}. \tag{26}$$

By symmetry, we also have

$$\frac{\partial y}{\partial p_x} = m\frac{M_{23}}{M} - x\frac{\partial y}{\partial r}. \tag{52}$$

Since the determinant M is symmetrical, $M_{ij} = M_{ji}$, and the first terms on the right side of (26) and (52) are equal to each other. We have, then,

$$m\frac{M_{32}}{M} = m\frac{M_{23}}{M}, \tag{53a}$$

or

$$\frac{\partial x}{\partial p_y} + y\frac{\partial x}{\partial r} = \frac{\partial y}{\partial p_x} + x\frac{\partial y}{\partial r}, \tag{53b}$$

as the general conditions which the demand curves (46) must satisfy, and which do not depend for their validity on the constancy of the final utility of money or on the measurability of utility.[27]

If the demand functions are linear:

$$\begin{cases} x = c_1 + c_{11}p_x + c_{12}p_y + \ldots + c_{1r}r \\ y = c_2 + c_{21}p_x + c_{22}p_y + \ldots + c_{2r}r \\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot, \end{cases} \tag{54}$$

[27] See Slutsky, *op. cit.*, p. 15.

Slutsky makes use of (53b) to derive more general conditions. Probably the most significant of these from an economic point of view is his equation (56), p. 16, which, when converted into elasticities, becomes

$$\eta_{xp_x} + \eta_{xp_y} + \eta_{xp_z} + \ldots = -\eta_{xr}.$$

This equation indicates very clearly the fallacy involved in taking the negative of the elasticity of demand for (X) with respect to income ($-\eta_{xr}$) as an approximation to its elasticity of demand with respect to its own price (η_{xp_x}). For, even if each of the other elasticities is negligible, their sum is not necessarily negligible, since there are many of them.

conditions (53b) assume the simple form:

$$c_{12}+yc_{1r}=c_{21}+xc_{2r}\ . \tag{55}$$

Conditions (53) may also be expressed in terms of elasticities:

$$k_x(\eta_{xp_y}+k_y\eta_{yr})=k_y(\eta_{yp_x}+k_x\eta_{yr})\ , \tag{56}$$

which brings out very clearly its relation to the simpler conditions (49b).

Although Slutsky does not give a definition of complementarity, the conditions (53a) which he deduced enable us to define this notion in the following terms: *Two commodities* (X) *and* (Y) *are completing, independent, or competing, according as*

$$m\,\frac{M_{12}}{M}=m\,\frac{M_{21}}{M}\gtrless 0\ ; \tag{57a}$$

or, from (53b), according as

$$\frac{\partial x}{\partial p_y}+y\,\frac{\partial x}{\partial r}=\frac{\partial y}{\partial p_x}+x\,\frac{\partial y}{\partial r}\gtrless 0\ . \tag{57b}$$

The economic significance of this definition may be understood most easily from (57b). The first term in this equation, or $\partial x/\partial p_y$, measures the *total* effect on the demand for (X) of a unit change in the price of (Y). This effect, it should be recalled, is made up of two parts: (1) a *direct* effect, or that resulting from the opportunity which the price change offers of using more (or less) of (X) in place of other goods; and (2) an *indirect* effect, or that resulting from the change in the real income of the individual which the change in price entails.[28] Now the latter is measured by $-y\,\dfrac{\partial x}{\partial r}$. Consequently, when this quantity is subtracted from the *total* effect, the difference $\dfrac{\partial x}{\partial p_y}+y\,\dfrac{\partial x}{\partial r}$ measures the *direct* effect

[28] The *direct* effect is the change in consumption corresponding to a compensated variation in price.

See equations (26), (27), (30), and (31) and the explanation given on pp. 444–47.

on the demand for (X) of a unit change in the price of (Y). Similarly, the right-hand member of (57b) measures the *direct* effect on the demand for (Y) of a unit change in the price of (X). The general definition of complementarity (57) then means that, if the *direct* effect of a reduction in the price of one of the goods is to increase the quantity demanded of the other good [both members of (57b) negative], the commodities are completing in consumption; and if the *direct* effect of a decrease in the price of one of the goods is to decrease the quantity demanded of the other [both members of (57b) positive], the commodities are competing in consumption.

The general definitions (57b) may also be expressed in terms of elasticities, as follows: *Two commodities* (X) *and* (Y) *are completing, independent, or competing, according as*

$$k_x(\eta_{xp_y}+k_y\eta_{xr}) = k_y(\eta_{yp_x}+k_x\eta_{yr}) \gtrless 0 . \tag{58}$$

This follows from (57b) and (56).[29]

In the special case of the linear demand functions (54), which we considered above, the definition (57b) states that the two commodities (X) and (Y) are completing, independent, or competing according as

$$c_{12}+yc_{1r} = c_{21}+xc_{2r} \gtrless 0 . \tag{59}$$

The second term of each member of (53b) will ordinarily be positive, since an increase in income ordinarily gives rise to an increase in the quantity demanded of any commodity.[30] It follows, therefore, that the two terms of each member of (53b) will differ in sign when the goods are completing in consumption, since the sum of the terms must then be negative. The two terms

[29] As I indicated on pp. 446–47, the elasticity of complementarity used by Hicks and Allen has the same sign as the elasticity of demand with respect to a compensated variation in price, (57) or (58). The technical relation between the two definitions was given on p. 447.

[30] In the exceptional cases in which $\partial x/\partial r$ is negative, the demand curve may have a positive slope. See Slutsky, *op. cit.*, p. 14, or Hicks and Allen, *op. cit.*, pp. 68–69.

may also differ in sign when the goods are competing and the indirect effect of the change in price outweighs the direct effect.

The simpler conditions (45) and (49) are, respectively, special cases of (57b) and (58), and are satisfied only if the indirect (or income) effect of a change in price either is negligible as compared with the direct effect or is of equal importance for the two commodities. This is easily seen by putting $y\frac{\partial x}{\partial r}=x\frac{\partial y}{\partial r}$ in (57b), and $\eta_{xr}=\eta_{yr}$ in (58). However, it is only when the indirect effects are negligible that the sign of the members of (45) [or of (49)] may be taken as a definition of complementarity. If the indirect effects are equal but not negligible, then the members of (45) [or of (49)], though equal to each other, may differ in sign from the members of (57b). That is, the second term in each member of (57b) may be sufficiently large to determine the sign of the entire expression.[31]

Although the definition of complementarity (57) appears as a natural generalization of the Edgeworth-Fisher-Pareto definition (50), which frees it from the assumption that utility is a measurable quantity, the two definitions do not become equal to each other, even when we assume that utility is measurable, i.e., that a definite sign can be given to such expressions as φ_{xy}. Consider first the special and limiting case in which the individual purchases only two commodities. According to definition (50), the two commodities may be completing, independent, or competing in consumption; but according to definition (57), they can only be competing. This is evident from Figure 1, which shows that any fall in the price of (Y) that is accompanied by a compensating variation in the individual's income must cause a decrease in the quantity of (X) demanded (OX_2 is less than OX_1). In other words, the *direct* effect of a fall in the price of (Y) is to decrease the consumption of (X)—which is the test for competing goods according to definition (57).[32]

The two definitions also yield different results in the normal case where the number of commodities exceeds two. If, for ex-

[31] See also Hicks and Allen, *op. cit.*, pp. 72, 202, 213.

[32] See *ibid.*, pp. 69, 202.

ample, the commodities (X), (Y), (Z), ... , are independent in consumption according to definition (50):

$$\varphi_{xy}=\varphi_{xz}=\varphi_{yz}= \ldots . =0 ,$$

they are *competing* with one another, according to definition (57), for the sign of $m\frac{M_{23}}{M}$ is then positive. Again, if, according to definition (50), a pair of commodities is competing, and all the other pairs are independent:

$$\varphi_{xy}<0 , \qquad \varphi_{xz}=0 , \qquad \varphi_{yz}=0 , \ldots . ,$$

then, according to (57), the given pair must also be competing. Finally, if, according to definition (50), one pair of commodities is completing and all the other pairs independent:

$$\varphi_{xy}>0 , \qquad \varphi_{xz}=0 , \qquad \varphi_{yz}=0 , \ldots . ,$$

then, according to (57), the given pair may be completing, independent, or competing.

The foregoing anomalous results are all traceable to the essential difference in the *operations* by which the relation existing between any two commodities is determined. According to (50), if we wish to know whether two commodities are completing, independent, or competing to an individual, we must ask him (and he must be able to tell us) whether, as we increase the quantity of one of the goods, the final utility of the other increases, remains constant, or decreases. The operation calls for an *introspective comparison* of final degrees of utility, on his part. The size of his income and the number of commodities in the economy do not affect his ability to make the comparison in question. According to (57), if we wish to know whether the individual considers two commodities as completing, independent, or competing, we must note his income, and observe whether a fall in the price of one of the goods, accompanied by a compensating variation in his income, will cause him to increase, maintain constant, or decrease

his purchases of the other. Instead of *observing* his behavior, we may, of course, *ask* him what his demand would be under various price and income conditions, and thus derive our test from replies which are based on introspection. The point is, however, that the answers called for by (57b) do not require a comparison of final utilities and *may* be obtained by observing the individual's market behavior; whereas the answers called for by (50) *cannot* be so obtained.[33]

Another, and possibly more significant, way of stating the difference between (50) and (57) is this: The former places no restriction on the way in which the various goods are to be combined in consumption. It simply compares the changes in the final utility of a good, due to increases in the quantity of another good. The latter presupposes a *limited range* of alternative combinations—that given by the line t_2T_2 in Figure 1—which can be purchased with an income adjusted so as to compensate for the price change, and the selection of the most favorable combination from this range. In view of the more restricted nature of the choices allowed by (57), it is not surprising that it should classify a wider range of goods as competing than (50).[34]

VI. Application to the Demands for Beef, Pork, and Mutton

As a statistical test and illustration of the theoretical relations presented in the foregoing section, I shall deduce the concrete, statistical demand functions for beef and veal, pork, and mutton and lamb, and compare the interrelations existing among them with those required by theory. More specifically, I shall express the demand for each of the three commodities in two forms:

$$x = c_1 + c_{11}'p_x + c_{12}p_y + c_{13}p_z + c_{1r}r + c_{1t}t \,, \tag{60}$$

[33] See Slutsky, *op. cit.*, pp. 19–23, for a proof of this statement.

[34] As I have already pointed out, Hicks and Allen define competing and completing goods by a relation similar to my (57), but they explicitly reject the corresponding definition of independent goods, adopting in its place a definition which conforms to (50) when the assumption is made that utility is measurable (see Hicks and Allen, *op. cit.*, pp. 74–76, 214–18).

and

$$x = A_1 p_x^{a_{11}} p_y^{a_{12}} p_z^{a_{13}} r^{a_{1r}} e^{a_{1t}t} , \tag{61}$$

and then study the extent to which the simple conditions (45) and the more complex conditions (53b) are satisfied by each set of demand equations. In these equations the independent variables are the prices of the three commodities, income, and time, the last being a catchall for those factors which have not been taken into consideration in our equations and which change slowly and smoothly with time.

Equation (60) is, of course, the linear demand function (54) with an additional term involving the time variable. Equation (61) may be reduced to a linear form by taking logarithms of both sides. It has two very interesting properties:

1. The exponent of any price is the elasticity of demand of (X) with respect to that price, and the exponent of income is the elasticity of demand of (X) with respect to income:

$$a_{11} = \eta_{xp_x} , \qquad a_{12} = \eta_{xp_y} , \qquad a_{13} = \eta_{xp_z} , \qquad a_{1r} = \eta_{xr} . \tag{62}$$

2. The coefficient of t measures the relative rate of shift of the demand curve with time:

$$\frac{1}{x} \cdot \frac{\partial x}{\partial t} = a_{1t} . \tag{63}$$

We shall find, however, that in our equations this coefficient is not significantly different from zero, and hence may be neglected.

A. THE DATA

Table I gives the quantity, price, and income series for 1922–33 which we shall use in deriving our statistical demand curves.

The quantity series are all total yearly per capita consumption as estimated by the U.S. Department of Agriculture. The data for 1933 are preliminary unofficial estimates.

Estimates of the total per capita consumption in the United States of each of the three kinds of meats are available annually

from 1900. Estimates of apparent per capita consumption from federally inspected meats are available monthly since 1916, and

TABLE I

DATA USED IN THE ANALYSIS OF THE DEMANDS FOR BEEF, PORK, AND MUTTON IN THE UNITED STATES, 1922–33

Year	Beef and Veal		Pork		Mutton and Lamb		Income	Deflators	
	Per Capita Consumption* (Lb.) (x)	Deflated Retail Price† (Cents per Lb.) (p_x)	Per Capita Consumption* (Lb.) (y)	Deflated Retail Price† (Cents per Lb.) (p_y)	Per Capita Consumption* (Lb.) (s)	Deflated Retail Price† (Cents per Lb.) (p_z)	Per Capita‡ (Deflated Dollars) (r)	Population§ (Thousands)	Index of Cost of Living‖ (1923–25 = 100)
1922	67.7	24.92	66.1	41.71	5.0	37.69	573.5	109,873	97.1
1923	69.1	25.20	74.7	38.77	5.2	37.15	628.8	111,537	98.8
1924	69.8	25.35	74.7	38.13	5.2	37.32	639.0	113,202	99.4
1925	70.9	25.64	67.6	44.50	5.2	37.92	654.7	114,867	101.8
1926	71.8	26.37	65.7	47.95	5.5	38.09	661.3	116,532	102.4
1927	65.8	28.04	68.5	46.21	5.4	38.82	675.9	118,197	100.2
1928	58.5	32.73	73.9	44.34	5.6	39.80	688.1	119,862	99.0
1929	58.2	34.89	72.8	45.74	5.8	40.67	686.8	121,526	98.6
1930	56.9	33.40	69.3	46.26	6.6	36.99	648.4	123,191	94.9
1931	56.5	30.29	69.6	43.39	7.1	34.50	596.7	124,070	85.5
1932	54.2	27.94	72.2	34.99	7.0	30.94	519.8	124,822	76.6
1933	60.0	25.34	73.1	32.79	6.9	29.54	504.5	125,693	73.8
Mean	63.28	28.34	70.68	42.06	5.88	36.62	623.12	.....	.....
Standard deviation	6.20	3.45	3.14	4.64	0.76	3.22	59.41	.....	.....

* *1934 Yearbook of Agriculture*, p. 623.

† For 1922–28, *Bureau of Labor Statistics Bulletin No. 495* (1929), pp. 4, 32–35; and for 1928–33, *Retail Prices and Cost of Living, B.L.S. Bull. R.70* (December, 1933), pp. 5–7; deflated by cost-of-living index (last column).

‡ Total income: For 1922–25, W. I. King, *National Income*, p. 74. For 1926–28, Leven, Moulton, and Warburton, *America's Capacity To Consume*, pp. 152–53, column "All Income" minus column "Business Savings" minus imputed income as given by King, *National Income*, p. 74. For 1929–33, R. F. Martin, "The National Income, 1933," *Survey of Current Business*, Jan., 1935, p. 17. Total income was then deflated by population and by cost of living.

§ Population: *Statistical Abstract of the U.S.* (1933), p. 10.

‖ Cost-of-living index: for 1922–26, Paul H. Douglas, *Real Wages*, p. 60; and for 1926–33, National Industrial Conference Board, *Survey of Current Business*, 1931 supplement and later issues.

are probably more reliable. For our purposes, however, it is better to work with the total consumption data, since their use

simplifies the interpretation of the conditions (45) and (53b).[35] But a preliminary analysis of these data showed that they are not homogeneous over the entire period from 1900. Consequently, it was decided to confine this analysis only to the data for the twelve years from 1922 to 1933.

The definition of "consumption" and the adequacy and reliability of the data for our purposes may be inferred from the following statement of Mr. Preston Richards, of the Bureau of Agricultural Economics:

> The meat production and consumption estimates . . . . have been computed . . . . on a dressed-weight or fresh meat basis with the edible offal excluded. The estimate of total meat production includes the estimate of meat produced from livestock slaughtered under Federal inspection, meat produced from slaughter in wholesale establishments not having Federal inspection, meat produced from slaughter in retail establishments, and meat produced from farm slaughter. . . .
>
> Data on slaughter of livestock under Federal inspection are of course available each year, but estimates of livestock slaughtered outside of federally inspected plants were estimated on the basis of such information as was available, using of course the census data for the years reported.
>
> The estimates of consumption of the various meats represent the disappearance of such meats in continental United States. . . . . It is necessary to convert exports and imports to their equivalent carcass weight in order to reduce all figures to a comparable basis. The ratios used . . . . were determined from information supplied by those familiar with packinghouse operations. . . . . The exports and imports used . . . . include shipments to the non-contiguous territories, Alaska, Hawaii, and Puerto Rico. . . . .
>
> . . . . allowance was made for the differences in the quantities of meats . . . . in storage at the beginning and end of each year. . . . . The actual quantities reported in storage were converted to a fresh or dressed-weight basis by using conversion factors similar to those used in converting the exports and imports.
>
> In computing meat production from Federally inspected slaughter, allowance was made for animals condemned as unfit for human food but no such allowance was made with respect to other slaughter or for spoilage of any kind.

[35] These integrability conditions apply directly only when the variables in the demand equations are total consumption and total income. If only indexes of consumption and/ or income are used, the integrability conditions need not be satisfied unless the partial derivatives in (45) and (53b) are adjusted so as to conform with the values they would have had if total consumption and income figures had been used.

Per capita consumption . . . . was computed by dividing the estimated total consumption by the total population in continental United States on July 1 of each year as estimated by the Bureau of the Census.[36]

The greatest source of error in these estimates of per capita consumption is admittedly in the estimates of non-inspected slaughter; but since the former are very highly correlated with the presumably more reliable series of consumption from federally inspected slaughter, it is probable that the same results would be obtained from both series.

The price data are all derived from the average annual retail prices collected by the Bureau of Labor Statistics. These prices are computed "by dividing the sum of all prices for an article . . . . by the total number of reporting firms."[37] The composite prices used for beef and pork are weighted averages of five grades of beef and three pork products. The weights are in each case the estimated proportions which the cuts or products represent of the carcass of the animal in question.[38] The price used for mutton is that of leg of lamb, since this is the only grade of mutton for which prices are quoted.[39] The prices of the various grades of beef and pork fluctuate in such close sympathy that a high degree of reliability can be attached to the year-to-year movement of the composite prices. The only effect of different systems of

[36] Letter of Dr. O. C. Stine, of April 23, 1935. I am grateful to Dr. Stine and to Mr. Richards for this information, as well as for many other courtesies.

[37] *Bureau of Labor Statistics Bulletin No. 495* (1929), p. 12.

[38] For beef the cuts and weights are: sirloin steak, 7; round steak, 15; rib roast, 9.5; chuck roast, 17; plate beef, 15.

For pork the products and weights are: pork chops, 1; bacon, 1; and ham, 1. These weights, which were supplied by Mr. Preston Richards through Dr. L. H. Bean of the U.S. Department of Agriculture, differ considerably from those used by the Bureau of Labor Statistics in computing its retail price index (see *Bureau of Labor Statistics Bulletin 495*, p. 13). The Bureau of Labor Statistics weights represent family consumption as determined by the 1918 budget study. The marked difference between the two sets of weights is strange, since it should be expected that the proportion in which the various cuts are consumed tends to be the same as the proportion which they form of the carcass. The explanation of the divergence probably lies in the relatively small and biased sample from which the Bureau of Labor Statistics weights were secured.

[39] The price series actually used have been adjusted for changes in the cost of living. The deflator used will be discussed below.

weighting, or (presumably) of including more grades, would be to change the level of the entire series.

The income estimates which served as the basis for the per capita real income series given in Table I are the estimates of total national income (excluding imputed income) prepared for the National Bureau of Economic Research. While this series is probably less sensitive to short-time fluctuations in income than is such a series as the Bureau of Labor Statistics index of industrial pay-rolls, it was chosen because (1) it gives actual estimates of income, rather than indexes of changes in income, and (2) it is much more inclusive.[40] The income figures were reduced to a per capita basis by dividing by the population of continental United States on July first of each year as estimated by the Bureau of the Census.

The three price series and the income series were deflated by a cost-of-living index obtained by combining the index computed by Professor Paul H. Douglas in his *Real Wages in the United States* and the National Industrial Conference Board monthly index of the cost of living. The former was used for 1922–26; the latter, for 1926–33.[41]

B. THE STATISTICAL DEMAND FUNCTIONS

Having selected the statistical series to be used, we must next decide whether to treat the quantity or the price of the com-

[40] The Bureau of Labor Statistics index gives no representation to income from other than industrial sources. This, combined with the pronouncedly greater growth of the service industries relative to manufacturing industries during the twenties, probably accounts for the steeper upward trend of the National Bureau income series. However, the year-to-year fluctuations of the two series are quite similar.

[41] Douglas' index, which extends only to 1926, is based very largely on the data used in computing the Bureau of Labor Statistics cost-of-living index. The procedure used in computing it differs, however, from that used by the Bureau of Labor Statistics in two important respects: (1) the Bureau of Labor Statistics weights retail prices by the average consumption of workers for the country as a whole, while Douglas weights the prices for each city by the average consumption of workers in that city and computes an index for each city; (2) the Bureau of Labor Statistics, in computing the average price, does not weight the price quotations, while Douglas obtains his average index by weighting the cost-of-living indexes for the several cities by the population of those cities. For the period from 1926 to date the National Industrial Conference Board series was chosen in preference to the Bureau of Labor

modity as the dependent variable in our demand equation. If we take quantity as the dependent variable and fit the curve by minimizing the sum of the squares of the residuals of this variable, we are assuming that an observed point fails to fall on the demand curve because of an "error" or deviation in quantity alone, the independent variables (prices and income) being allowed no deviation. In fact, this assumption gives each of the independent variables a weight infinitely greater than that given to the dependent variable in the curve-fitting process. Conversely, if we fit the curve by treating the price as the dependent variable, we are assuming that an observed point fails to fall on a curve because of an "error" or deviation in the price variable, the quantities and income being allowed no deviation. This procedure considers the quantity (and income) observations so reliable that they are given weight infinitely greater than that assigned to the price data. And, as it may be expected, the results obtained by the two methods may be quite different.[42] Actually, both sets of variables are subject to error; but it is exceedingly difficult, if not impossible, to make allowance for this fact in the curve-fitting process. In the present investigation, however, the quantity series are known less accurately than the price and income series, so that the selection of the quantities for the dependent variables of our demand equations is likely to yield better approximations to the true demand relations. Furthermore, the general theoretical conditions (53b) and (56) can be calculated more easily when the quantities are taken as the dependent variables. Consequently, we shall confine our investigations to this type of demand function.

In Table II linear demand functions of this type for beef, pork,

---

Statistics index because it is more convenient to get a yearly average from it, since it is a monthly index, the Bureau of Labor Statistics index being given only for June and December. The two series fluctuate in close sympathy for the period 1926–33. The National Industrial Conference Board index was spliced onto the Douglas index by multiplying each item by the ratio of the 1926 value of the Douglas series to the 1926 value of the National Industrial Conference Board series. The items in the final series were adjusted so that the average for 1923–25 equals 100.

[42] See my *Statistical Laws of Demand and Supply* (Chicago, 1928), pp. 35–70, 178–86.

and mutton are arranged in groups. In the first group, the demand for each of the three commodities is expressed as a function

TABLE II

THE LINEAR DEMAND FUNCTIONS FOR BEEF, PORK, AND MUTTON IN THE UNITED STATES, 1922–33

x, y, z = Per capita consumption of beef, pork, mutton (in pounds)
p_x, p_y, p_z = Deflated retail price of beef, pork, mutton (in cents)
r = Deflated per capita income (in dollars)

(The figures in parentheses are standard errors)

	Constant Term	p_x	p_y	p_z	r	R*	R'*	ϵ†
$x=$	63.3140	−1.8560 (0.1589)	+0.1575 (0.1866)	+0.4976 (0.4056)	+0.0445 (0.0238)	0.9801	0.9686	1.6109
$y=$	71.0080	+0.4340 (0.0790)	−1.1672 (0.0928)	−0.1302 (0.2017)	+0.0662 (0.0118)	0.9809	0.9698	0.8010
$z=$	10.2925	+0.1323 (0.0137)	+0.0518 (0.0161)	−0.3037 (0.0351)	+0.0012 (0.0021)	0.9901	0.9845	0.1394
$x=$	66.3955	−1.8999 (0.1596)	+0.1987 (0.1892)	.....	+0.0680 (0.0145)	0.9758	0.9666	1.6610
$y=$	70.2017	+0.4455 (0.0741)	−1.1780 (0.0879)	.....	+0.0600 (0.0067)	0.9797	0.9720	0.7713
$x=$	62.8571	−1.8224 (0.1511)	.....	+0.5592 (0.3917)	+0.0507 (0.0222)	0.9781	0.9697	1.5817
$z=$	10.1426	+0.1433 (0.0196)	.....	−0.2835 (0.0508)	+0.0033 (0.0029)	0.9754	0.9661	0.2049
$y=$	77.3543	.....	−1.0397 (0.1936)	−0.3799 (0.4235)	+0.0818 (0.0247)	0.8937	0.8505	1.7265
$z=$	12.2270	.....	+0.0907 (0.0551)	−0.3798 (0.1206)	+0.0060 (0.0070)	0.8489	0.7847	0.4917

* R is the coefficient of multiple correlation; R' the coefficient of multiple correlation corrected for the number of parameters in the regression equation. The relation between the two coefficients may be inferred from the following formulas:

$$R^2 = 1 - \frac{[vv]/n}{[(x-\bar{x})^2]/n} = 1 - \frac{S^2}{\sigma^2},$$

$$R'^2 = 1 - \frac{[vv]/(n-k)}{[(x-\bar{x})^2]/(n-1)} = 1 - \frac{\epsilon^2}{\mu^2},$$

where the v's are the residuals, $\bar{x}$ the arithmetic mean of x, n the number of sets of observations, and k the number of parameters.

† ϵ is called the quadratic mean error and is defined by the relation:

$$\epsilon^2 = [vv]/(n-k).$$

It is the ordinary "standard error of estimate" corrected for the number of parameters in the equation.

of the three prices and of income; the three commodities are here considered as a closed set. In the other groups each pair of commodities which can be formed from the original set of three is in turn looked upon as a closed set, and the demand for each member of the pair is expressed as a linear function of the two prices and of income. Time is not included among the independent variables because it turned out to be of no significance.[43]

Attention naturally centers on the first group. The diagonal terms in this group are all negative, which shows that, other things being equal, an increase in the price of any of the commodities is associated with a decrease in its consumption. Since these terms are between 8.5 and 12.5 times their respective standard errors, they are almost certainly significant. The other terms (including the regressions on income) do not have such relatively small standard errors, and three of them are even smaller than their respective errors, thus increasing the difficulties of interpretation. The coefficients of multiple correlation are all very high, and the quadratic mean errors are all very small—which indicates that the fitted curves are in good agreement with the observations. The demand for any of the three commodities is more influenced by its price than by any other factor or by all of the other factors taken together. Thus the three prices and income account for 96 per cent of the variance (σ^2) of x (beef), for 96 per cent of the variance of y (pork), and for 98 per cent of the variance of z (mutton). But p_x, p_y, and p_z singly account for 71 per cent, 97 per cent, and 94 per cent of the variances of x, y, and z, respectively, the rest of the variance being imputed (posi-

[43] If we add the additional time variable t to the independent variables of each of the first three equations of Table II and recompute the equations, we obtain for the coefficients of t the values

$$\begin{matrix} -0.0041, \\ (0.6005) \end{matrix} \qquad \begin{matrix} -0.2748, \\ (0.2768) \end{matrix} \qquad \text{and} \qquad \begin{matrix} -0.0394, \\ (0.0498) \end{matrix}$$

respectively, and for the three R'-s the values

$$0.9632, \qquad 0.9697, \qquad \text{and} \qquad 0.9836,$$

respectively.

It will be observed that the regression coefficients are all less than their standard errors. Furthermore, the R'-s are less than the corresponding R'-s of the first three equations in Table II. It is clear, therefore, that t is a superfluous variable.

tively or negatively) to all the other variables. It is the relatively small influence on demand of all variables other than the price of the commodity in question, coupled with the errors in the data, which makes the analysis of complementarity so difficult and so inconclusive.[44]

Although the fit of these demand curves to the data appears excellent, thus verifying the assumption that all the regressions are linear, a graphic analysis of the observations brought to light the fact that the net relation between the quantity of beef and its price is not linear and that the coefficient of regression, -1.8560, does not give a very good fit. From the scatter it appeared that a constant-elasticity curve might give a better fit, without increasing the number of parameters of the curve.[45] Accordingly, I fitted such a curve to the data for beef, and for comparative purposes also fitted constant-elasticity curves to the data for pork and mutton.

Table III, which corresponds to Table II, is a summary of the results obtained. While the constant-elasticity curves give, on the whole, better fits (compare the values of R or R' in the two tables), a graphic analysis of the scatter diagram of x' and p'_x (when allowance is made for the fluctuations in the other variables) indicates that the relation between these two variables is also non-linear, and that the constant-elasticity curve does not give a measurably better fit than the straight line. It is inadvisable, however, to experiment with more complex curves, since we have only twelve observations. Furthermore, the constant-elasticity equations yield directly all the elasticities of demand. Although these could also have been computed from the entries in Table II—and the corresponding elasticities would have approximately the same values in the two sets—the use of constant-elasticity curves has the additional advantage of yielding a direct determination of the least squares standard errors of these constants.

[44] Part of the difficulty is also traceable to the correlations which exist among the independent variables, but lack of space prevents a treatment of this technical problem.

[45] With only twelve observations, we should not be justified in fitting more complex curves.

C. THE THEORETICAL CONDITIONS AND THEIR OBSERVED VALUES

As soon as we proceed to use the results of Tables II and III for testing the extent to which the integrability conditions (45) and (53b) are statistically satisfied, we are faced with at least two theoretical difficulties:

TABLE III

THE CONSTANT-ELASTICITY DEMAND FUNCTIONS FOR BEEF, PORK, AND MUTTON IN THE UNITED STATES, 1922–33

x', y', z' = Logs of per capita consumption of beef, pork, mutton
p'_x, p'_y, p'_z = Logs of deflated retail price of beef, pork, mutton
r' = Log of deflated per capita income

(The figures in parentheses are standard errors)

	Constant Term	p'_x	p'_y	p'_z	r'	R^2*	R'^2*	ϵ^2*
$x'=$	1.2302	−0.8576 (0.0679)	+0.0955 (0.1142)	+0.2010 (0.2139)	+0.4810 (0.2095)	0.9836	0.9741	0.0101
$y'=$	1.1948	+0.1945 (0.0322)	−0.7009 (0.0543)	−0.0037 (0.1017)	+0.5422 (0.0996)	0.9820	0.9716	0.0048
$z'=$	1.5377	+0.6347 (0.0704)	+0.3669 (0.1186)	−1.7951 (0.2220)	+0.1851 (0.2175)	0.9892	0.9830	0.0105
$x'=$	1.0864	−0.8754 (0.0647)	+0.1212 (0.1101)	.....	+0.6302 (0.1238)	0.9815	0.9745	0.0100
$y'=$	1.1975	+0.1948 (0.0290)	−0.7014 (0.0493)	.....	+0.5393 (0.0554)	0.9820	0.9752	0.0045
$x'=$	1.1615	−0.8412 (0.0637)	.....	+0.2439 (0.2037)	+0.5285 (0.1978)	0.9819	0.9751	0.0099
$z'=$	1.2735	+0.6980 (0.0970)	.....	−1.6302 (0.3103)	+0.3676 (0.3013)	0.9691	0.9644	0.0151
$y'=$	1.1597	.....	−0.6059 (0.1210)	−0.1747 (0.2274)	+0.6962 (0.2241)	0.8827	0.8345	0.0112
$z'=$	1.4231	.....	+0.6771 (0.3767)	−2.3531 (0.7081)	+0.6876 (0.6981)	0.8541	0.7925	0.0348

* For definitions of these terms see notes * and † in Table II.

In the first place, these conditions will in general contain the independent or dependent variables, as is indicated for example by (55). If we had the "true" demand functions, the conditions would be identities, satisfied for any consistent set of the vari-

ables. The statistical demand curves are, however, only approximations to the "true" demand curves. At best they may be considered as giving the first few terms of a Taylor's expansion of the "true" functions about a particular point. Geometrically, they may be thought of as surfaces tangent to the "true" demand surfaces at the point about which the expansion is made. It follows that if the integrability conditions hold for the "true" demand functions at every point, they need hold for the statistical functions only at the point of tangency. But what is this point of tangency? We know that it cannot be zero (no consumption), for the problem would then be meaningless. But that is all. There is, however, some justification for considering it as the point corresponding to the arithmetic means of the independent variables, as that is the most "representative" point. Accordingly, we shall relate all of our computations to this point.[46]

The second major difficulty is that the theoretical conditions relate to the demand of a single individual, while our statistical results are the aggregated demands of a large number of individuals. The question arises: If the integrability conditions are satisfied for the demand curves of each individual, will they also be satisfied for the market demand curve? It can be shown that the simple conditions (45) have this property. But the more complex conditions (53b) do not appear to have this property except under extremely rigid assumptions.[47]

[46] It might seem that by using the integrability conditions expressed in terms of elasticities [(49) and (56)] we could escape the difficulty of defining the point of tangency, since these conditions hold apparently at every point on the demand surface. But these conditions involve the proportions spent on the various commodities, and these proportions vary from point to point on the demand surface, unless the latter has an elasticity of 1 at every point. The difficulty cannot be dodged; a "representative point" must also be selected in this case. We have defined it as that point which corresponds to the arithmetic mean of the independent variables.

[47] Thus, for example, if each individual consumes the same amount of a particular commodity and any increase in total income is distributed equally among the individuals, the integrability conditions will hold for the aggregate demand function if they hold for each individual function. (These assumptions do not imply that each person has the same demand function; the partial derivatives may vary from person to person.) The integrability conditions will also be satisfied for the aggregate demand curve, if we assume that the partial derivatives of the quantity of each commodity with respect to income is the same for each individual, and make no assump-

If, therefore, the more complex integrability conditions are not satisfied by the (market) demand curves derived from statistics, it does not necessarily follow that they are not satisfied by the individual demand curves. But we shall see that the indirect income effect is very small as compared with the direct effect, so that the simple integrability conditions are not seriously modified by them; and these hold for the market as well as for the individual demand curves.

We are now ready for the testing of the theoretical conditions by our statistical findings. These conditions, it should be recalled, may be stated either in terms of the slopes of the curves [equations (45) and (53b)] or in terms of their elasticities [equations (49) and (56)]. Although the two ways of stating the conditions must yield the same conclusions,[48] since they are equivalent, the slope relations lend themselves to a somewhat simpler interpretation.

Table IV is a summary of the integrability conditions in terms of these relations. It is based on the first three equations of Table II. As an illustration of the economic meaning of the calculated conditions, we may consider the first line of this table. The entries in columns 1, 3, and 5 all show different aspects of the effect on the demand for beef of a 1-cent increase in the price of pork. The first entry (column 1) shows that the *total* effect of a 1-cent increase in the price of pork is to raise the per capita consumption of beef by 0.1575 lb. per annum. As we have already shown, this

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tion as to the relative consumptions of the various individuals or as to the way in which an increase in total income is distributed among the individuals. These seem to be the only *simple* assumptions under which the integrability condition is valid for the aggregate if valid for each individual. The general condition for this to be true is quite complicated.

The source of the difficulty is, of course, traceable to the impossibility of defining uniquely a procedure for aggregating individual demands with respect to changes in income, when the relations which exist between these incomes are not given. But a consideration of this problem is beyond the scope of this study.

It may appear that since all the variables are in "per capita units" (except the prices), the difficulty will be overcome by considering the results as relating to a "representative" individual. But this would not be a solution of the difficulty; it would be merely a refusal to face it squarely.

[48] Equations (49b) and (56) will not yield the same numerical results as equations (45) and (53b) because they have been divided by the income, r.

total effect is made up of two parts: one direct and the other indirect. These are entered in columns 3 and 5 (line 1). The entry in column 3 shows that *if* the rise in price of pork were accompanied by a compensating rise in income, the ***direct*** effect would be for the decrease in the consumption of pork (which, by Table II, equation 2, is 1.1672 lb.) to be partly counterbalanced by the substitution of 0.1890 lb. of beef.[49] But, in fact, the increase in

TABLE IV

THEORETICAL CONDITIONS ON DEMAND FUNCTIONS EXPRESSED IN TERMS OF SLOPES AND THEIR VALUES AS CALCULATED FROM THE LINEAR DEMAND EQUATIONS FOR BEEF, PORK, AND MUTTON IN THE UNITED STATES, 1922–33

u, v = Quantities demanded of any two commodities

(The figures in parentheses are standard errors)

Pairs of Commodities	Hotelling Condition*		Slutsky Condition†‡		Indirect (Income) Effect‡		Probable Type of Relation
	$\frac{\partial u}{\partial p_v}$	$\frac{\partial v}{\partial p_u}$	$\frac{\partial u}{\partial p_v}+v\frac{\partial u}{\partial r}$	$\frac{\partial v}{\partial p_u}+u\frac{\partial v}{\partial r}$	$-v\frac{\partial u}{\partial r}$	$-u\frac{\partial v}{\partial r}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Beef and pork	0.1575 (0.1866)	0.4340 (0.0790)	0.1890	0.4759	−0.0315	−0.0419	Competing
Beef and mutton	0.4976 (0.4056)	0.1323 (0.0137)	0.5002	0.1331	−0.0026	−0.0008	Competing
Pork and mutton	−0.1302 (0.2017)	0.0518 (0.0161)	−0.1263	0.0526	−0.0039	−0.0008	? Independent

* Equation (45). † Equation (53b).

‡ The unit of income (dollars) has been changed to cents in order to put it on a comparable basis with the unit in which the prices are expressed.

the price of pork is not automatically accompanied by an increase in income. That is, the rise in the price of pork when money income (in terms of the 1923–25 dollar) is held constant is equivalent to a fall in real income.[50] The effect of this fall is to *decrease* the per capita consumption of beef by 0.0315 lb., as can be seen from column 5 (line 1). This is the ***indirect*** effect on the demand for beef of the 1-cent increase in the price of pork. From this it follows that column 1 = column 3 + column 5; or that the total effect on the demand for beef of a 1-cent change in the price

[49] There will, of course, also be other substitutes for pork. Thus, from column 4, line 3, we see that 0.0526 pounds of mutton will be substituted for pork.

[50] See above, n. 9.

of pork (0.1575 lb.) is equal to the direct effect (0.1890 lb.) plus the indirect effect (−0.0315 lb.).

Similarly, the entries in line 1, columns 2, 4, and 6, give respectively the total, direct, and indirect effect on the demand for pork of a 1-cent change in the price of beef: (0.4340 lb.) = (0.4759 lb.) + (−0.0419 lb.).

The Hotelling condition is that the two *total* effects should be equal to each other. The Slutsky condition is that the two *direct* effects should be equal to each other. Actually, the two conditions are satisfied only approximately, the more general Slutsky condition, which is free from the assumption of the measurability of utility and the constancy of the final utility of money, yielding approximately the same results as the simple Hotelling condition. The explanation of this fact is, of course, to be found in the smallness of the indirect effect. Compare column 5 with column 3, and column 6 with column 4.

For beef and pork, the two terms of the Slutsky condition are positive: the direct effect of an increase in the price of one of the goods is to increase the quantity demanded of the other. Assuming that these terms are statistically significant, we may conclude that the two commodities are competing in consumption. The same conclusion also follows from the Hotelling condition. By the same test we find that beef and mutton are also competing. The type of relationship which exists between pork and mutton is, however, difficult to determine, since the two terms in the condition equation have different signs. But, since the standard error of the negative term is nearly twice as large as the term itself, the latter may be taken as zero and the two commodities may be considered independent in consumption.

We now turn to Table V. In this table the relations of Table IV, which are deduced from the first three (linear) equations of Table II, are converted into elasticities and compared with the corresponding conditions deduced from the first three (constant-elasticity) equations of Table III. The conditions derived from the linear and from the constant-elasticity demand curves are in fairly close agreement. In the latter, as in the former, the indirect or income effect is small as compared with the direct effect, so

TABLE V

THEORETICAL CONDITIONS ON THE DEMAND FUNCTIONS EXPRESSED IN TERMS OF THE ELASTICITIES AND THEIR VALUES AS CALCULATED FROM THE LINEAR AND FROM THE LOGARITHMIC (CONSTANT-ELASTICITY) DEMAND EQUATIONS FOR BEEF, PORK, AND MUTTON IN THE UNITED STATES, 1922–33

u, v=Quantities demanded of any two commodities

(The figures in parentheses are standard errors)

PAIRS OF COMMODITIES AND TYPE OF DEMAND EQUATION*	HOTELLING CONDITION†		SLUTSKY CONDITION‡		INDIRECT (INCOME) EFFECT		PROBABLE TYPE OF RELATION
	$100k_u\eta_{up_v}$ = $100k_v\eta_{vp_u}$ (1) (2)		$100(k_u\eta_{up_v}+k_uk_v\eta_{ny})$ = $100(k_v\eta_{vp_u}+k_vk_u\eta_{ny})$ (3) (4)		$-100k_uk_v\eta_{ny}$ (5)	$-100k_vk_u\eta_{ny}$ (6)	(7)
Beef and pork:							
Equation:							
Linear.....	0.3015	= 0.8305	0.3617	= 0.9107	−0.0602	−0.0802	Competing
Logarithmic..	0.2750 (0.3289)	= 0.9278 (0.1536	0.3410	= 1.0022	−0.0660 (0.0288)	−0.0744 (0.0137)	
Beef and mutton:							
Equation:							
Linear.....	0.8294	= 0.2202	0.8338	= 0.2215	−0.0044	−0.0013	Competing
Logarithmic..	0.5789 (0.6160)	= 0.2190 (0.0243)	0.5838	= 0.2207	−0.0049 (0.0002)	−0.0017 (0.0022)	
Pork and mutton:							
Equation:							
Linear.....	−0.3220	= 0.1280	−0.3124	= 0.1301	−0.0096	−0.0021	? Independent
Logarithmic..	−0.0176 (0.4851)	= 0.1266 (0.0409)	−0.0087	= 0.1296	−0.0089 (0.0016)	−0.0030 (0.0036)	

* The linear equations used are the first three in Table II; the constant-elasticity equations are the first three in Table III. The proportion k of income spent on each commodity is an average for 1922–33 obtained by multiplying the mean price by the mean quantity and dividing by the mean income. This yielded the values k_x=0.0288, k_y=0.0477, and k_n=0.00345.

† Equation (49b). ‡ Equation (56).

that the Hotelling conditions and the corresponding Slutsky conditions are of approximately the same order of magnitude.

This result is to be expected whenever the elasticities of demand with respect to income are of the same order of magnitude as the cross elasticities of demand. For then the second term in each member of the Slutsky condition (56) will be a of smaller order of magnitude than the first term (or the whole expression), since it contains two factors each of which is less than unity and ordinarily quite small while the first term contains only one such factor.[51]

VII. Conclusions

1. With the development of his general law of demand, Pareto has corrected, completed, and extended the work of Walras and others on the relation of utility to demand; with the explicit introduction of income into the demand function, Slutsky, and, later, Hicks and Allen, have rendered a similar service to Pareto. Given the tastes (utility function) of an individual, we now know how to express his demand for any commodity as a function of its price, of all the other prices, and of his income.

[51] Hicks and Allen use equations corresponding to (26) and (52) [or to (30) and (31)], in which they employ the notion of elasticity of complementarity instead of the elasticity of demand with respect to a compensated variation of price. Now their elasticity of complementarity is $1/k_y$ times our elasticity of demand with respect to a compensated variation of price, $m\frac{M_m}{M}\cdot\frac{p_y}{x}$. It follows that if our assumption that η_{xr} is of the same order of magnitude as η_{xp_y} is fulfilled, then the elasticity of demand with respect to a compensated variation of price will also be of the same order of magnitude as η_{xr}, and the elasticity of complementarity will be very much greater than η_{xr}. Similarly, if, as Hicks and Allen suggest on their p. 72, n. 2, pp. 213–14, and p. 213, n. 2, the elasticity of complementarity is of the same order of magnitude as the income elasticity, then the elasticity of demand with respect to a compensated variation of price will be very much smaller than the income elasticity, i.e., the second term of each member of (56) will be of the same order of magnitude as the first term (or the whole expression).

The question of which of the two assumptions is the more nearly satisfied in practice is of course one that can be settled only by actually obtaining the numerical values of the various elasticities. For the commodities considered in this paper the conclusion seems clear that it is the income elasticities and the elasticity with respect to a compensated variation in price (rather than the elasticity of complementarity) which are of about the same order of magnitude, and that consequently the conditions are such that the simple integrability condition should be satisfied and that they also should indicate by their sign the type of relation existing between the two commodities.

2. In this study we have: (*1*) given a proof of the interrelations of demand, price, and income in a simple manner; (*2*) developed the implications of these interrelations on the demand for related (completing and competing) goods and on the elasticity of substitution; (*3*) pointed out some unsolved problems in this field; and (*4*) compared the theoretical findings with those yielded by the concrete, statistical demand functions for beef, pork, and mutton.

3. The equations summarizing the interrelations in question constitute a category of laws which is comparatively rare in the social sciences: they specify *quantitatively definite relations* which must exist between the variables—if the theory is true. They thus enable us to test the extent of the agreement between theory and fact.

4. Probably the most important of these relations is that given by the Slutsky condition, which is essentially a test of the rationality or consistency of human behavior in the market place, and which may be stated as follows: *The demand behavior of a rational or consistent individual is such that the* DIRECT *effect of a 1-cent increase in the price of* (X) *brings about the same change in his demand for* (Y) *that the* DIRECT *effect of a 1-cent increase in the price of* (Y) *brings about in his demand for* (X). The Hotelling condition, which I used in a previous study, is a special case of this one, and may be derived from it simply by substituting the word *total* for the word *direct*. The Slutsky condition is valid, whether or not utility is measurable, and whether or not the final utility of money is constant to the individual; but it does not necessarily hold for the aggregate demand function of two or more individuals except under rather rigid assumptions. The Hotelling condition assumes either that the final utility of money is constant or that the indirect (income) effect is the same for the two commodities; but it can be applied to the aggregate market demand function.

5. The application which we have made of the two conditions in testing the consistency of the behavior of the American consumer with respect to his demand for beef, pork, and mutton shows that the indirect effect is so small that the Slutsky and the Hotelling conditions are both satisfied equally well (or equally poorly). It is probable that the income effect is also small for

most articles of wide consumption on which only a small proportion of the income is spent. We may, therefore, expect the simpler Hotelling conditions to be satisfied by a large number of demand phenomena. But this supposition needs to be fortified by more extensive statistical investigations.

6. In terms of the Slutsky conditions, two commodities may be defined as completing or competing, according as the *direct* effect of an increase in the price of one of the goods is to bring about a decrease or an increase in the demand for the other. (We have seen that the two increases or decreases must be equal to each other.) The corresponding definition in terms of the Hotelling condition is a special case of the foregoing and may be derived from it by substituting the word *total* for the word *direct*.

7. These are not, however, the only definitions of complementarity that might be given, nor do the various definitions necessarily lead to the same conclusions when applied to the same demand functions. In fact, we have seen that even so apparently simple a concept as independent consumptions turns out to be a complex and elusive notion.

8. Whichever definition is adopted, the statistical demand functions for beef, pork, and mutton show that beef competes with mutton and also with pork, but that the demand relation between pork and mutton cannot be determined from the data, since the statistical evidence is conflicting. Thus, one equation apparently leads to the conclusion that the direct (and also the total) effect of an increase in the price of mutton is to *decrease* the quantity demanded of pork, while the other equation shows that the direct (and also the total) effect of an increase in the price of pork is to *increase* the quantity demanded of mutton, when, according to our theory, the two net effects must be both positive or both negative. However, the amount of the decrease in the demand for mutton is so insignificant statistically that without additional evidence we should be justified in considering it equal to zero. Under these conditions, perhaps the best guess is that pork and mutton are independent in consumption.

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THE FLUID-MILK PROGRAM OF THE AGRICULTURAL ADJUSTMENT ADMINISTRATION[1]

THE fluid-milk marketing program of the Agricultural Adjustment Administration is based on the same principle of discriminative marketing which is of such fundamental importance in the programs for wheat, cotton, and other export products. The milk program, however, differs from the others in four important respects: first, the discrimination is not between home and foreign markets but between the fluid uses and other uses of milk; second, the program is not on a nation-wide basis but is applied locally in dozens of different individual milk-sheds; third, it is put into effect not through the imposition of a processing tax but through direct price-fixing provisions contained in marketing agreements and federal licenses; and fourth, it contains no provisions for production curtailment to correspond with the acreage reduction contracts for wheat and cotton.

In the case of fluid milk the practice of discriminative marketing had been developed in local areas by the producers and distributors themselves long before the passing of the Agricultural Adjustment Act. Many of the peculiar features of the dairy program have resulted from the acceptance by the administration of these local arrangements as basic elements in the whole situation. As a result of the policies of local health authorities, the development of strong local co-operatives, and the understandings established between the co-operatives and the dealers, the fluid-milk milk-sheds of most of the important cities and many of the smaller places had become rather definitely marked off from one another and from the other dairy sections of the country. This demarcation of supply areas, together with the collective bargaining methods generally adopted, made it possible to

[1] The writer gratefully acknowledges the financial assistance from the Harvard Committee on Research in the Social Sciences which made possible most of the statistical work upon which this paper is based.

take advantage of the highly inelastic character of the demand for fluid milk and to obtain for the milk utilized in this way prices which were higher relative to the prices of cream and butter than would otherwise have been the case. That being so, it was not unnatural that the producers around these fluid-milk markets should appeal to the administration for a special program of their own based on the systematic application under government sanction of the same general principles.

In the present paper an attempt is made to analyze the effects of these price-raising methods. The investigation upon which it is based centered in the Boston market but the analysis given is general in character and the empirical evidence cited is known to be typical of all the important milk-sheds where the program has been put into effect. It should be noted, however, that no attempt is made here to deal with the long-run improvements in the marketing and price-making set-ups that are expected to result from the work of the administration.

The determination of prices.—The practice of discriminative marketing as applied to milk involves, first, the fixing of a price for that part of the supply that is sold by the dealers as fluid milk at a level which is higher relative to cream and butter prices than would be established under freely competitive conditions, and, second, the acceptance of a price for the balance of the supply which is at the normal competitive level with respect to these other types of dairy products. These prices are referred to as the Class I price and the Class II price. It will be observed at once that price raising under these conditions is a much easier matter than it would be in a market where discrimination was not possible. The adjustment of the supply of fluid milk to the demand for it at the arbitrarily fixed price can be brought about without any change being made in the actual output of the producers. It can be accomplished merely by the diversion of some of the milk from fluid uses into other uses. For the milk so diverted the farmers get only Class II prices, but as a result of the whole procedure the total returns obtained by the producers of these milk-sheds are undoubtedly increased.

In analyzing the economic principles involved in the operation

of these arbitrary price-raising plans, it will be convenient to make use of the accompanying diagram (Fig. 1). It will also be convenient to confine our attention in this section of the paper to the immediate direct effects of price discrimination and to assume that the total quantity of milk marketed remains unchanged. This quantity is represented by the distance OQ in the chart.

The line DD taken with reference to the price axis OY and the quantity axis OX represents the net demand in a given milk-shed

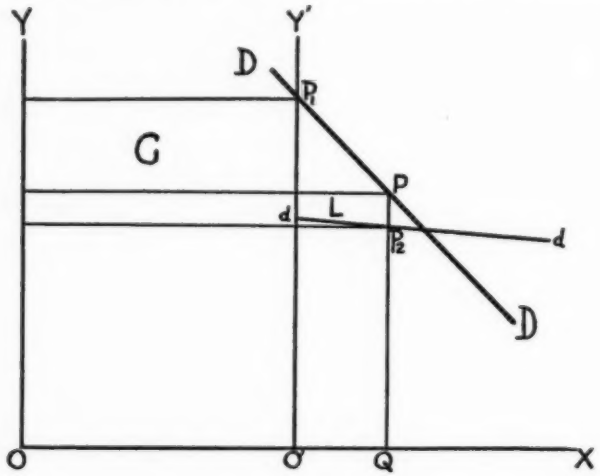

FIG. 1

for milk for fluid consumption, ignoring, as we may for the sake of simplicity, the operating reserves necessarily carried by the dealers. It represents not the retail demand for milk delivered to consumers, nor the wholesale demand for milk delivered to the dealers' city plants, but the net derived demand for milk at the farms after all deductions have been made for the costs of transportation and marketing. A difficulty arises here in giving precision to this concept owing to the fact that the farm prices are naturally different at different distances from the market, but for the purpose of the present analysis it will be satisfactory to take the prices at the territorial margin of the milk-shed as representa-

tive of the prices prevailing throughout the whole area. That being so, it is evident that under freely competitive conditions the equilibrium price determined by the intersection of *DD* and the perpendicular from *Q* would be established at *P*.

Suppose now that the practice of discriminative marketing is introduced and the price of milk for fluid use is raised to $O'P_1$. Only the quantity OO' can be sold at this price, and the balance of the *supply*, $O'Q$, has to be utilized in the making of cream or butter or some other kind of dairy product. The demand for milk in this Class II market is represented by the line *dd* taken with reference to the price axis $O'Y'$ and the quantity axis $O'X$. Under these conditions the Class II price will be established at the level QP_2. Before the adoption of this marketing policy the farmers sold the quantity OQ for the price QP. Now they sell part of the supply, OO', for a higher price, $O'P_1$, and part of the supply, $O'Q$, for a lower price, QP_2. The increase in their total returns depends on the extent to which their gain on the first part exceeds their loss on the second, on the amount by which the rectangle *G* in our diagram is greater than the rectangle *L*.[2]

If the price-differential is accurately determined, total returns can always be increased through the practice of charging a higher price in the Class I market whenever the demand in the Class II market is more elastic (or less inelastic) than the demand in the Class I market, and the greater the difference between their elasticities, other things being equal, the greater is the opportunity presented for gain. It is not necessary for the success of the plan that the Class I demand should actually have an elasticity of less than unity, but the probability is that in the cases most favorable for discriminative marketing it will have.

The marketing of milk in any large consuming center presents an exceptionally favorable opportunity for profitable discrimination. The Class I demand is highly inelastic; the Class II demand is distinctly elastic; and more or less effective means can usually

[2] For discussions of this problem see: Jacob Viner, "Dumping" in the *Encyclopedia of the Social Sciences;* Theodore Yntema, "The Influence of Dumping on Monopoly Price," *Journal of Political Economy*, December, 1928; and Joan Robinson, *Economics of Imperfect Competition*, chap. xv.

be found to prevent fluid milk being brought in from outside the recognized supply area. For the various reasons we would expect the consumers' demand for fluid milk to be inelastic: it is an essential food for children, it is recommended in definite daily rations by nutrition experts, its use even by adults is a matter of daily routine, it is recognized to have high food-value in proportion to its cost, it is sold in units which are large relative to the quantities used by individual families each day, and it is commonly obtained through standing orders for early-morning doorstep deliveries. It is the general opinion of those actually engaged in the marketing of fluid milk that the demand is inelastic and this opinion is confirmed by an examination of the statistical evidence relating to the Boston market. During the ten-year period from 1922 to 1931 there were seventeen occasions when the retail price per quart was raised by one cent and seventeen occasions when it was lowered by the same amount. Each time the price was increased (or decreased) the fluid sales for the following month were below (or above) what would have been expected from the index of normal month-to-month changes, but in no case was the difference in volume between normal and actual nearly as great proportionately as the change in price with which it was associated. On the average it was found that a change in price of approximately 7 per cent was accompanied by a deviation from the normal volume of less than one-half of 1 per cent. This indicates that the retail demand for fluid milk is highly inelastic.

What then may we conclude about the Class I demand at the farm? It is derived as we know from the ultimate consumers' demand by deducting the necessary charges for transportation, processing, and city distribution. These charges are characteristically rigid. Railroad rates do not vary with the volume of fluid milk marketed, and an investigation of dealers' margins in a dozen different cities of the United States made in connection with this study indicates that they have become almost as rigidly fixed in cents per quart as the freight charges. It follows then mathematically, since the marketing costs per quart remain practically constant regardless of the quantity sold, or the price, that the demand at the farm must of necessity be more inelastic

than the retail demand from which it is derived. A reduction in the retail price from 13 cents to 12 cents, for example, represents a change of less than 8 per cent, but the consequent reduction of the farm price from 6 cents to 5 cents represents a change of $16\frac{2}{3}$ per cent. In this case the elasticity of demand at the farm would be only half as great as in the consumers' market.

Turning now to consider the Class II demand, we perceive at once that the elasticity must be great. The diversion of 10 per cent of all the fluid milk consumed in urban markets would mean an addition of between 3 per cent and 4 per cent to the total national supply of manufactured dairy products. If the total demand for manufactured dairy products has an elasticity of unity, as the Washington authorities have concluded from their investigations, the effect of increasing the supply by this amount would be to depress the price by approximately 3 per cent or 4 per cent. As a result of this lowering of the price, production in areas outside the milk-sheds would be decreased to some extent and the price would be restored part way to its former level. There is thus a marked difference in degree of elasticity between the Class I demand and the Class II demand, and a tempting opportunity is consequently presented for the profitable practice of discriminative marketing.

The Class I price, f.o.b. Boston, from March 16 to August 31, 1934, was $2.95 per hundredweight. The Class II price, varying slightly from pay period to pay period, averaged about $1.00. It should be observed that these prices are quoted on an f.o.b. city basis[3] and that no estimate of the extent to which the Class I price has been artificially raised can be made from a direct comparison of them. In order to have a basis for making such an estimate, it is necessary to consider the relations that would normally exist under freely competitive conditions between the price of milk and the prices of other dairy products.

It must be recognized that, even in the absence of any discrimination, the f.o.b. city price of fluid milk would be higher than

[3] These are the prices paid by dealers at their city plants and differ from the prices received by the farmers by the costs of transportation and handling at country plants.

the price of its cream equivalent in the form of butter (or any other manufactured dairy product). This is due in part to the fact that the sanitary requirements for fluid milk are usually somewhat higher than those for cream or butter. It is also due in part to the fact that farmers selling cream or butter retain the skim milk for feeding hogs or other livestock. But it is due mainly to the difference in the cost of shipping the product in the three different forms. To ship a hundred pounds of milk costs about eight times as much as to ship the cream that could be made from it, and to ship the cream costs about fifty times as much as to ship the butter that could be made from it.[4] Suppose now (ignoring for the moment the sanitary differentials and the valuation of the skim milk) that the prices obtainable f.o.b. city for these equivalent quantities of these different products were the same, then at all points in the surrounding territory the farmers would obtain their best returns from milk used in the manufacture of butter and none would be available for shipment as either fluid milk or cream. In order that cream shall be obtained its price at the city must be higher than the equivalent price of butter, and for fluid milk the price must be higher than the equivalent price of cream.

FIG. 2

When the prices do differ in this way it will be found most profitable for the producers nearest the market to ship fluid milk, for others at intermediate distances to ship cream, and for those who are farthest from the market to ship butter. The natural relations of the milk, cream, and butter zones around an isolated market are illustrated in a conventional way by Fig. 2.[5]

With relative shipping costs as indicated in the diagram, the dividing line between the milk and cream zones would tend to establish itself at a distance from the market where the freight charges on milk were equal to 8/7 of the difference between their delivered prices, and the dividing line between the cream and butter zones would tend to establish itself at a distance where

[4] Because of differences in weight and differences in freight classifications.

[5] It must be understood, of course, that distances from the center in this diagram actually represent freight costs rather than mileage.

the freight charges on cream amounted to 50/49 of the difference between their prices. If, for example, the delivered price of milk were $3.00 and the price of its cream equivalent were $2.65, the dividing line between these zones would be at a distance where the freight on milk was 40 cents [8/7 of ($3.00−$2.65)]—say 200 miles. The freight on cream would be 5 cents, and at this distance the price to the farmers for either milk or cream would be $2.60. Here the farmers are at the margin of transference and may choose with equal advantage either method of disposal. At any point less than 200 miles from the market the price of milk would be higher than the price of cream and at any point more distant than 200 miles it would be lower. Producers in the milk zone could not economically ship anything but milk; producers in the cream zone could not economically ship anything but cream; and similarly producers in the butter zone could not afford to ship anything but butter.

It must be recognized that we are, in fact, concerned here with a complicated system of equilibrium relations in which many different factors mutually govern one another. No change could be made in the price of any of the products without resulting, theoretically at least, in a readjustment of the other prices and the zone margins. Similarly no change could take place in the supply conditions in any of the zones nor in the freight schedules without calling for all-around readjustments. What is really important from the point of view of the present study is the fact that, as a result of these adjustments, under freely competitive conditions certain definite relations would tend to be maintained between the price differences, the relative shipping costs, and the distances of the zone margins from the market center.

To determine the extent to which the present Class I price in the Boston market is above its normal competitive level, it is necessary to undertake an empirical investigation of these various factors. Beginning with an analysis of the data on actual market receipts of milk and cream we find that enough milk is produced within 225 miles of the city to supply its fluid needs.[6] It is true that at the present time some of this milk is actually being shipped

[6] There is a seasonal variation of 30 to 40 miles in the position of this margin but for our present purpose it is the average position which is significant.

as cream, but since this is due almost entirely to the existence of certain uneconomical institutional arrangements, we may properly regard the area within this radius of 225 miles as the necessary or natural milk zone under existing conditions of supply and demand. It is found from these data that the cream zone includes not only the New England territory adjoining the milk zone but also some territory in the mid-western states. Actually about 35 per cent of the Boston cream supply comes from states to the west of New York and Pennsylvania. Most of the butter and cheese is obtained also from this western territory. The cream and butter zones overlap, but there is a noticeable tendency for the market to reach out farther for its butter supply than for its cream.

The value of cream in the western dairy area depends directly on the price of butter. Out of every hundred pounds of milk containing 3.7 per cent butter fat there can be made 4.6 pounds of butter.[7] The cost of manufacturing the butter and putting it on the wholesale market may be taken as approximately equal to the cost of selling the fluid cream and preparing it for long distance shipment. During the months of March, April, and May, 1934, the wholesale price of 92-score butter on the Chicago market averaged about 23 cents per pound. Therefore the value of the cream equivalent of one hundred pounds of 3.7 per cent milk at a western shipping point must have been about $1.06 (4.6×$0.23). The cost of shipping this cream from Adrian, Michigan, one of the most important of these western sources, to Boston, would be roughly 16 cents, which would make the value at Boston $1.22. The competitive value of the same amount of cream on a New England farm at the margin between the milk and cream zones would be less than this by the cost of hauling it to a country plant and shipping it the 225 miles to Boston. This cost would be about 11 cents[8] and the value would consequently be $1.11. The corresponding price for fluid milk would

[7] The weight of butter is greater than the weight of the butter fat used in making it because it contains also a certain amount of water and salt. The overrun here assumed is 24 per cent. This is probably higher than the average actually obtained.

[8] That is one-eighth of the cost for milk which is 89 cents made up as follows: hauling 25 cents, station charge 20 cents, and freight 44 cents.

have to be higher than this by an amount sufficient to induce the producers to meet the more stringent sanitary requirements imposed and to compensate them for the feed value of the skim milk. Although there is no very satisfactory basis for estimating this amount, it seems reasonable to put it at about 30 cents (10 to 15 cents for the skim milk and 15 to 20 cents for the sanitary premium). This brings the farm price of fluid milk up to $1.41 per hundredweight. To obtain the f.o.b. city price we add to this 89 cents for hauling, station charge, and freight. The natural competitive Class I price for the Boston market computed in this way is $2.30. And finally, deducting this from the actual Class I price of $2.95, we find a difference of 65 cents.

It would be incorrect to conclude from the foregoing analysis that the net gains of the New England farmers from the practice of discriminative marketing are equivalent to 65 cents per hundredweight on their Class I milk. Allowance must be made for the fact that as a result of this practice the total supply of butter would have been increased and its price consequently lowered below the level at which it would otherwise have been established. Allowance must also be made for the fact that with lower Class I prices the intensity of production would be decreased and the necessary limits of the milk zone would have to be extended.

The control of production.—In our earlier discussion we confined our attention to the immediate direct effects of the price discrimination, assuming that the total quantity of milk marketed remained the same. We must now proceed to consider the production responses of the farmers and the further adjustments necessary to re-establish equilibrium. It will be convenient, for this purpose, to refer to Figure 3, which is an elaboration of Figure 1. The line *DD* represents, as before, the net demand at the farms for milk for fluid consumption. The line *SS* represents, in a corresponding way, the supply responses of the producers (ignoring seasonal variations) to the net prices they receive at their farms. These lines relate to the axes *OY* and *OX*. The line *dd*, relating to the axes *O'Y'* and *O'X*, represents the net demand at the farms for milk for Class II purposes and the dotted line *dd'* is the marginal revenue curve derived from it. It should be noted

that the chart is intended only to indicate in a general way the nature of the adjustment involved and that the character given to the curves is entirely arbitrary.

The nature of the supply responses actually made will depend on the method employed in making the payments to the individual producers. The simplest and most natural method is to calculate the average price obtained for all the Class I and Class II milk that is sold by the different pooling groups and to pay each

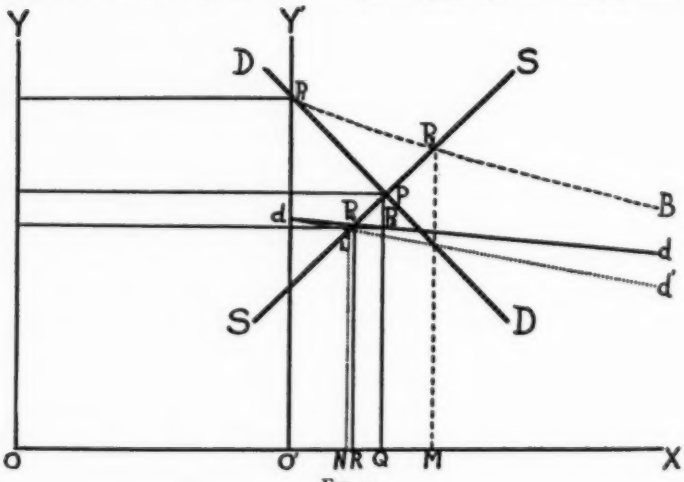

FIG. 3

individual for the amount he contributed on the basis of this "composite" or "blended" price. It was substantially on this basis that the members of the New England Milk Producers' Association (supplying the Boston market) were paid from 1918 to 1931. The blended prices that could be obtained for various quantities of milk under the conditions represented in Figure 3, with OO' units of fluid milk sold at the price $O'P'$, are indicated by the broken line P_1B. It is evident at once that the price received when the quantity OQ is marketed is more than sufficient to call forth this supply. For a balance to be reached the supply would have to be increased to OM and the blended price thereby reduced to MP_3.

Actually, given the Class I price (P_1),[9] the maximum gains from the policy of discriminative marketing could be obtained only if production, instead of being increased, were reduced to ON. With this volume of output the cost of producing the marginal or ONth unit, is just equal to the additional revenue obtained from its sale (L being the intersection of SS and dd'). Although it would clearly be to the advantage of the producers as a group to have output reduced to this volume, it is extremely difficult to bring this about when production is carried on by so many different individual producers. The methods of payment which have the greatest tendency to reduce output are the "base-rating plans," but even they have failed to attain the desired objective. Under such plans each farmer is given a "base" or "quota" representing his share of the Class I sales on which he is to receive the Class I price and on all milk in excess of this amount he gets only the Class II price. It would appear, therefore, that production should be reduced to OR (R being perpendicularly below the intersection of SS and dd at P_4) but in actual fact these plans have all given the farmers an incentive to expand production beyond the point where marginal costs are covered by the Class II price. The return obtainable by an individual farmer for his final unit of production generally has been greater than the Class II price. Under dynamic conditions provision has to be made for the alteration of base-ratings from time to time and no method of revision seems more natural than to make the changes in ratings depend on past production performances. The result of this has been that producers have received for each hundredweight of excess milk not only an immediate cash payment equal to the Class II price but also a claim to further gains through the sale of additional Class I milk in the future.

Base-rating plans were originally designed to deal with problems arising from the seasonal variation of production and not to regulate the total volume of production. A common procedure at first was to give each farmer a new rating every year equal to

[9] Practical considerations will probably prevent the Class I price from being set, in fact, as high as would be required theoretically to obtain the maximum gains from the two markets.

(or proportionate to) his production in the fall months of the preceding year. When this was done it was to the interests of the individual farmers to expand their outputs until their marginal costs were just covered by the blended prices they received. As a matter of fact this type of rating plan, by giving such an exceptional stimulus to fall production, tended to make farmers miscalculate their own best interests and to establish levels of output that could not be profitably maintained. Later, as a result of experience, modifications were made which prevented producers from increasing their ratings so easily. Nevertheless, except for short periods in certain markets where bases were declared temporarily unalterable, an increase of production has invariably constituted a claim to an increased base rating.

The practice of discriminative marketing is in the absence of output control almost certain to result in the production of a larger volume of milk than would be called forth under freely competitive conditions. The absolute amount of the increase will depend, of course, on the slope of the line *SS* and this in turn will depend on the actual conditions under which production is being carried on in the particular milk-shed under consideration. It will depend also on the length of time that is to be allowed for adjustments to take place and on the direction in which the production changes are supposed to be taking place. The simplest and quickest way of bringing about a change in the volume of milk production is by changing the amount of concentrated feed that is given to the cows, but there are rather definite limits beyond which these variations cannot easily be carried. Permanent changes of greater magnitude are likely to be brought about through changes in the number of cows kept and in the amount of land devoted to dairying. In some milk-sheds it may be possible, when enough time is allowed, for the total output to be greatly increased or decreased without material alteration in the unit costs of production. These conditions would be most likely to prevail in an area where farming was diversified and productive resources could be readily transferred from one type of enterprise to another. On the other hand, in a region such as New England where the alternatives to dairying (except in limited areas) are

relatively few and unattractive, adjustments will be less easy to make.

Recognizing the vague and unsatisfactory character of this general conclusion, an attempt was made to attain greater precision through a statistical analysis of the price changes that have taken place in the past and the production responses that have actually been made to them. It was known from the start that exceptional difficulties were involved in the statistical analysis of supply[10] but encouragement was drawn from the fact that earlier studies of the responses of milk producers to price changes had given results that were reasonable and correlation coefficients that were relatively high. The study made by Mordecai Ezekiel[11] in 1927 on the basis of Vermont data for the period 1917–25 was taken as a model for the present one. His method of analysis was applied to data drawn from exactly the same source covering the more recent and more normal period from 1921 to 1931. Aside from the adoption of a more appropriate ratio for the conversion of the cream figures into their whole-milk equivalents and the use of a New England index of feed prices instead of the Cornell index, the procedure was unaltered, but the results obtained were so entirely different that no confidence can now be felt in the validity of either study. Where he got a coefficient of determination of 0.790, the repetition of his analysis with more recent data yielded a coefficient of only 0.035.[12]

We find ourselves still, at the end of this empirical investigation, without any adequate basis upon which to estimate the effects of the discriminative marketing policy on production in the fluid-milk milk-sheds. We can proceed only by considering certain more or less probable estimates. The practice of discriminative marketing tends to increase the butter supply in two ways, by decreasing the sales of fluid milk and by increasing

[10] See J. M. Cassels, "The Nature of Statistical Supply Curves," *Journal of Farm Economics*, April, 1933.

[11] "Farmers' Response to Price in the Production of Milk," mimeographed report issued by the United States Department of Agriculture.

[12] A similar attempt resently made by Paul Quintus at the University of Minnesota to bring down to date Emil Rauchenstein's analysis of responses in the Twin Cities' area gave results which were even more inconsistent than these.

production within the fluid-milk milk-sheds. The inelastic character of the consumers' demand for milk, the large proportion of the butter supply produced outside the milk-sheds, and the compensating adjustments that naturally take place in the production of competing areas, make it seem very unlikely that the price of butter has been lowered by more than one cent per pound (i.e., by more than 4 per cent of its present level). This means that the figure used above for the cream value of a hundredweight of milk may have been below the long-run competitive level by as much as $4\frac{1}{2}$ cents. The effect of the discriminative marketing policy on the necessary radius of the milk zone is a matter of minor importance in the Boston area because it happens that the volume of production is great on both sides of the dividing line. A reduction of 10 per cent in the amount of milk produced within 225 miles of the city could be compensated for merely by reaching out another eight or ten miles for supplies. This would occasion an increase of less than one cent per hundredweight in the costs of transporting milk from the outside margin of the milk zone. When these facts are taken into account in our analysis, we are led finally to the conclusion that the present price per hundredweight for fluid milk f.o.b. Boston is higher by about 60 cents than it would have been if freely competitive conditions had always prevailed. With fluid sales amounting, as they do, to 60 per cent of the total production in the recognized supply area of the Boston market, this is equivalent to an increase of about 36 cents in the composite price. Subject to the qualifications noted above, it constitutes a gain for the producers of more than 25 per cent on the average farm prices they would otherwise receive. How much of this gain is due directly to the program of the Agricultural Adjustment Administration cannot be definitely ascertained. Even without any government interference the price of fluid milk at Boston would probably have been kept somewhat above its competitive level, but the differential would almost certainly have been much smaller than it now is.

Although our attention so far has been centered on the possible gains of the fluid-milk producers it must not be supposed that this is the only aspect of the program that requires consideration. It is impossible to undertake here an examination of all its effects,

direct and indirect, but the interests of the outside producers, the milk distributors, and the consumers cannot be passed over without some brief discussion. The dairy farmers in butter-making areas would be injured by any reduction that was brought about in the price of butter, but in actual fact it is certain that the depressing effects of the federal fluid-milk policy have been more than offset by the purchase with federal funds of 61 million pounds of butter for distribution through relief agencies to consumers who would not have been able to buy butter on their own account. This amount of butter is equivalent to about 7½ per cent of all the milk annually produced in the urban fluid-milk milk-sheds. It does not seem likely that production would have been reduced by this amount even at the prices that would have prevailed during the past few months in the absence of government interference. In the case of dealers there has apparently been a temporary loss of income through the narrowing of their margins. How much of this they will regain later on remains to be seen. The consumers are the people whose immediate interests have been most adversely affected. They are already paying more for their milk than they would otherwise have to pay, and if the dealers widen their spreads again they will have to pay still more. It is argued however, that they will benefit directly from the fact that farmers are enabled to maintain a high-quality milk supply, and indirectly from the fact that increasing purchasing power in the hands of the farmers will tend to promote general business recovery.

The pooling of the proceeds.—The problems involved in the distribution of the total gains from discriminative marketing among the individual farmers are of a different character from those with which we have been concerned in the preceding sections of this paper. They are not problems of economic analysis in the ordinary sense of the term. The gains are obtained through concerted action (in this case under government authority) and the individual shares are not automatically determined by the interaction of economic forces. The determination of these shares is a matter of deliberate planning and the choice of a basis on which to establish them is fundamentally a matter of equity or distributive justice rather than of economics.

Theoretically the administration might have chosen to dis-

tribute the benefits of its program on a simple per capita basis or in proportion to the needs of the different farm families covered by the scheme. In actual practice, of course, both of these methods of distribution were too radical to be considered and the effective choice was limited to three other possible bases, established fluid sales, volume of production, or bargaining strength. The adoption of established fluid sales as a basis for the distribution was strongly urged by some groups on the ground that it was only fair to allow the various co-operative organizations to retain the same shares in the fluid-milk market as their own efforts in the past had actually obtained for them. It could not be denied, however, that some of these marketing efforts had been of a predatory character benefiting particular groups at the expense of others but bringing no general benefit to the farmers of the milk-shed as a whole. On the other hand it seemed most natural, since the primary function of the dairy farmer is the production of milk, that the benefits from the federal program should be distributed according to the quantities of milk they contribute to the total supply. The principle of distributing the benefits according to the bargaining strengths of the different producer groups in the area was naturally rejected as a basis for the program, but in some particular cases as a matter of expediency concessions have in fact been made to groups in strategic bargaining positions in the market.

It still remained for the administration to decide in what way the volume of production should be measured. Should it be the volume of production in the months of September, October, and November, or should it be the average for all twelve months of the year? Should it be the actual volume of production during some period in the past and if so what particular period, or should it be the potential production of the farm and if so how is this to be determined? Should cream production be counted as equivalent to milk production or should credit only be given for deliveries of whole milk? Finally, should volume of production be measured in physical units or in terms of value?

Before going on to examine in detail the decisions that have been made on these points and the methods by which they have

been reached, it will be well at this point to explain briefly the elementary mechanics of the pooling operations. To accomplish the purpose of the administration the simplest procedure would have been to require all the distributors to pay the federal administrator for their milk according to a simple class-price plan and have him distribute the proceeds to the farmers according to their claims to share in the returns from the high-priced fluid sales. There was opposition to this procedure, however, and another method had to be devised which would accomplish the same end while still allowing the payments to be made by the dealers directly to the farmers or to their co-operative organizations. This method is described as "the equalization of sales." What a dealer should pay for his milk depends on the amount that he himself is able to dispose of in fluid form, but the returns which his producers should receive depend on the proportion of fluid sales in the market as a whole. In some cases the dealer will owe more for his milk than his own particular group of producers is entitled to receive, and in other cases he will owe less. It has been provided, therefore, that the dealers in the former situation shall pay the difference into an equalization fund, and that the payments to the producers supplying dealers in the latter situation shall be supplemented from this fund. In this way the farmers receive the same prices for their milk regardless of the use that is made of it by the particular dealers with whom they happen to be connected.

The returns due to the farmers individually depend not only on the total fluid sales in the market but also on the individul quotas they have been allotted in the Class I market. These quotas are known as "bases" or "base ratings." All the milk delivered by a farmer up to the amount of his base is paid for at the base price, which is intended to correspond closely to the Class I price, and all the milk he delivers in excess of that amount is paid for at the excess price, which is intended to correspond closely to the Class II price. It may be pointed out in passing that the closeness of this correspondence depends on the closeness with which the total deliveries of base milk correspond with the total fluid sales. If bases are expanded, as we have reason from our earlier

analysis to expect they will be, the correspondence will be destroyed.

With these arrangements in mind, we may now proceed to consider the methods of measurement adopted in establishing the federal bases and the modifications that have been made in them since they were first introduced. The first Boston license, which was put into effect on November 3, 1933, provided that bases in general should be determined by the volume of production in the months of September, October, and November, 1932. In the second license, effective March 16, 1934, one of the most important changes made was the alteration of this provision. The new license allowed the use of either the average for the fall months (September–November), 1933, or the average for the whole of the year, whichever would give the farmer the larger base. It is generally felt now that this is the more equitable method. The use of the September-November average in the first license was a carry-over from the earlier base-rating plans which had been specially designed to even out seasonal fluctuations in production by giving a special incentive to farmers to increase their outputs in those particular months. For this very reason the use of the fall average worked out inequitably in a milk-shed where some of the producers had been paid on base-rating plans in the past and others had not. Those who had already increased their fall production under the private-rating plans were in a position to gain at the expense of the others from the use of the 1932 September–November average in the establishment of the federal bases.

Under the original license the three smaller co-operatives that had remained outside the dominant marketing organization were required to pay into the equalization fund an amount of money equal to about 6 per cent of their total sales while the principal co-operative organization drew money out of the fund. Under the second license the smaller co-operatives taken together have had payments due them amounting to 1½ per cent of their sales. This change in the balance of debits and credits has resulted from the changes that have taken place in the base ratings of the different groups.

An analysis of the 1933 production records of all the farmers

who now supply the Boston market with milk shows that 56 per cent of them obtained higher bases through the use of the figures for the whole year than they would have obtained from the use of the fall figures. On the average their bases were 23 per cent higher than they would have been under the provisions of the old license. Among the members of the smaller co-operatives 70 per cent benefited from the use of the annual averages to the extent of about 25 per cent. The total bases of these three organizations were increased in this way by about 15 per cent. This has been the most important factor in bringing about the redistribution of the proceeds from the federal program that has taken place under the new license, and there can be little doubt that it has made the distribution more equitable than it formerly was.

As was pointed out above, the question may well be asked why the production of 1933 should constitute any better claim to a share in the Class I market than production in some other year in the past, or even the production of the current year 1934. In view of the efforts that have been made during the past few years to persuade farmers generally to reduce their outputs, it would hardly seem fair if the farmers who had responded to those appeals were now given bases lower than the farmers who had ignored them. For that reason the policy has been adopted in actual practice of adjusting bases, whenever appeals were made, in such a way as to give the producer the benefit of his highest volume of production in any year since 1930. The same principle was applied when appeals were made on the ground that the 1933 output had been reduced by disease or any other accidental cause. In the cases that were refused, the actual production figures obtained for 1933 were higher than for the earlier years. Most of the appeals that were rejected came from farmers who had lost cows through some accidental cause but who had replaced them at once and maintained production at its established level. When this was the case the decisions of the administrator could hardly have been different from what they were, but there were some cases of a different type where an upward revision of the bases might have been justified even although the 1933 figures were the highest on record. A considerable number of appeals were re-

ceived from young men who had only recently taken up farms of their own and who had not had time by 1933 to build up their herds to the sizes required for the most economical operation of their enterprises. Their plans for sound and efficient expansion have been suddenly interfered with, and the costs to them of restricting production are greater than in the cases of other farmers. It is actually more difficult for them to increase their base ratings than for new producers to enter the field now and get their initial ratings. It would seem to be both economically and ethically desirable to make it easier for these men to attain their optimum outputs. There are, however, administrative difficulties involved in the making of *ad hoc* decisions which have prevented any deviations being made from the general rules that were adopted for the handling of all the base rating appeals.

With regard to the acceptance of cream production within the Boston milk-shed as equivalent to milk production, a compromise has been made. Under neither the first nor the second license could a producer obtain a base until he had actually begun to deliver milk of the quality required for the market, but both licenses did provide that in the establishment of initial bases past deliveries of cream should be acceptable as evidence of the volume of milk produced. The insistence that all producers who are given bases must actually deliver milk has been objected to by some of the marketing organizations on the ground that this is an uneconomical arrangement when there is a surplus of milk being produced. Why, it is asked, should farmers be put to the unnecessary expense of hauling whole milk to the country plants and losing the feed value of the skim when the milk must in the end be run through a separator and marketed only in the form of cream? On the other hand it is argued that unless producers are actually delivering milk there is no means of being certain that they are capable of qualifying as milk producers.

Turning next to consider the unit in which production should be measured, we find that weight has been chosen unhesitatingly in every case in preference to value. It appears that the possibility of using the value unit has scarcely been recognized. The advantages of so doing have certainly not been fully appreciated.

There are practical difficulties involved in the use of the dollar unit, but they are by no means as great as might at first sight be supposed. On the other hand, there are some practical difficulties involved in the use of the hundredweight which could be overcome by giving due recognition to the values produced as well as to the physical volumes.

The principal difficulty of this sort is encountered in the establishment of bases for nearby producers. These producers object to sharing the market on equal terms with producers two hundred miles or more from the city. They insist that they have a natural right to sell all their milk in fluid form and that they should not be made to carry any of the surplus which is created by the shippers in the more distant zones. Unfortunately the economic bases of their claims have been obscured by the political arguments used to secure them artificial protection. It is true, as we saw from our analysis of the natural supply arrangements, that under freely competitive conditions these nearby producers would sell all their milk in fluid form. And it is true, as a matter of fact, that at the present time practically all their milk is used in fluid form although it is nominally pooled along with the receipts of milk and plant-separated cream from up-country points. It is also a fact that their land values and their taxes are higher than the more distant producers. But when they maintain that they should be allowed to sell all their milk at the Class I price established by the administration, they certainly overstate their claims. Under the competitive conditions which would assure them of 100 per cent fluid sales the price established would be much lower than this. The increase of price is obtained only through the concerted action, under government sanction, of all the producers eligible to ship milk to the Boston market and the gains must naturally be shared by all of them. The nearby producers do, however, have a legitimate claim to a larger share than they could actually obtain from a distribution that was made strictly according to physical volumes of production.

It must be recognized that when the distribution of the proceeds from the federal program is made on a basis of physical production the percentage increases in farm prices and farm in-

come will be greater in the distant zones than in those nearer to the market. Let us take figures that represent approximately the conditions in the Boston milk-shed. Suppose, for example, that the natural competitive farm price of milk at a distance of 225 miles from the market is $1.45 per hundredweight and the price at farms within easy trucking distance of the city is $1.90, then an increase in price of 36 cents per hundredweight would give the distant farmers a gain of 25 per cent while the gain of those nearby would be no more than 19 per cent. The cost of production in the nearby zones will normally bear about the same relation to the costs in the distant zones that the natural competitive prices bear to one another. It follows, therefore, that a price increase which is just sufficient to give the distant farmers a reasonable margin of profit will leave the nearby farmers still producing at a loss.

It is evident from this analysis that production measured in value terms would provide a more equitable basis for the distribution of the gains from the federal program than production measured in physical terms, even if the price figures used were only rough approximations to the natural competitive prices that would prevail in the different zones. Although the absolute levels of these prices could not be determined with any high degree of accuracy, the natural zone to zone differences, which are really of much greater importance for the present purpose, could be easily determined from an examination of the transportation charges actually being made. In actual practice the value figures would not have to be used in the computation of individual bases. The whole procedure would be relatively simple. Records of physical production would still be used, but the percentage of total production allowed as a base in each case would depend on the distance zone in which the producer's farm was located. These percentages would bear to one another the same relations as the natural prices in the different zones. To illustrate this we consider the bases that would be given to two farmers in the Boston milk-shed, one at a distance of 225 miles from the market and the other on the outskirts of the city. If the distant producer were given a base equal to 61 per cent of his production (as such pro-

ducers actually have been given), then the nearby producer would be entitled to a percentage bearing the same relation to 61 as the price $1.90 bears to the price $1.45, i.e., about 80 per cent.

Although the above line of reasoning has not been adopted by the administration, concessions have been made on other grounds to the producers whose milk is hauled by truck directly to the dealers' city plants. They have been given bases equal to 85 per cent of their established levels of production. This has been justified on the ground that the nearby producers are in an advantageous marketing position and could easily disturb the market if they undertook to peddle their milk at low prices direct to the consumers. It was also found from a study of price arrangements in the past that dealers had consistently made a practice of paying them on especially favorable bases.

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THE CHILEAN NITRATE INDUSTRY

THE Chilean nitrate industry has attracted attention and received discussion from a number of points of view. The effects of a government monopoly, competition between the natural nitrate of Chile and the synthetic product abroad, the dependence of the Chilean government on revenue from nitrate sales—all these aspects have been considered. However, these phases of the industry are not intelligible without a consideration of the business principles adhered to by the controllers of the industry in recent years. Consequently a review of the corporation finance which has characterized the industry will reveal some of the problems involved in Chilean nitrates and some of the difficulties experienced by the Chilean government.

The peculiar dependence of the Chilean government on revenue from nitrate exportation has put the business interests in the industry in a strategic position. This dependence derives from certain governmental practices which originated in Spanish colonial days. When Chile was part of a Spanish colony the ruling class lived by huge land grants worked by Indian labor. Even today some 60 per cent of the agricultural land in Chile is in the hands of owners of latifundia of more than 5,000 hectares in extent.[1] The proprietor lived by the produce that could be exacted from the Indian laborers. He collected tribute and considered himself a ruler rather than a farmer or business man. The break with Spain did not appreciably change this system. Such revenue as had been sent previously to Spain now remained in the possession of the ruling class, the landowners. In the course of the centuries this system continued. As extractive and manufacturing industries began to develop, the ruling class, on the whole, did not go directly into business but preferred to live by taxes collected from the exploiters of these industries.

[1] R. Carlos Keller, *La Eterna crisis Chilena* (Santiago, 1931), pp. 220 ff.; G. M. McBride, "The Agrarian Problem in Chile," *Geographical Review*, XX (October, 1930), 574–86.

Nitrates did not become important to Chile until 1879. At that time the Chilean Nitrate Company became involved in a dispute with the Bolivian government over tax payments. When the Bolivian government attempted to seize the property of the company in Antofagasta, at that time a part of Bolivia, the Chilean government intervened and war was declared. Peru also became involved because she possessed an adjacent nitrate province. The war lasted until 1883, but Chile finally conquered and took as indemnity the nitrate lands of Bolivia and Peru. Chile became the possessor of the world's only known deposits of nitrate of soda.

The government began to thrive on the new revenues derived from the taxes on nitrates. The windfall prosperity enabled the government to float bond issues and the public debt, particularly the foreign debt, increased rapidly. This, in turn, made the government more dependent on the nitrate industry. In 1891 the Congressionalists were able to overthrow the Balmaceda régime by taking possession of Iquique, a nitrate port, and depriving the Balmacedans of taxes.[2]

Nitrates were not the sole source of government revenue (copper was also important) but they were so important that the government's financial status could best be gauged by conditions in the nitrate business. The government could consequently be relied upon to aid the nitrate firms whenever they were in distress. The politicians, of course, might have gone directly into the nitrate business, but they considered this a socially degrading method of earning a living.

The first serious decline in the nitrate business came in 1914. Germany, formerly the best market for Chilean nitrates, was cut off by the outbreak of the World War and began manufacturing its own nitrate. Toward the close of 1914 the number of Chilean nitrate plants in operation fell from 134 to 43—91 being forced to close.[3] Other belligerents gradually replaced Germany as nitrate customers and business improved until 1917, the best year the industry had had. But after the war the slump reappeared. In

[2] Daniel Martner, *Historia de Chile, Historia Economica* (Santiago, 1929), Vol. I, 413 ff.; 453 ff.

[3] Martner, *op. cit.*, pp. 599–600.

1919 exports fell to the lowest point in volume since 1892.[4] The government and the nitrate companies were faced with the need for supporting the workers (since no other employment was available in the nitrate regions), with growing discontent, and a possible revolution as a result of shrinking governmental revenue.[5] The government anxiously sprang to the aid of the industry.

The government tried to keep the industry alive by issuing fiscal bills to the companies to a total of some 90,000,000 pesos by August, 1921. This was done on the basis of legislation passed in 1914. The government was to make advances up to 3 pesos per 100 pounds of nitrate produced, and up to 4 pesos per 100 pounds of nitrate in port ready for embarkation, to those nitrate producers who agreed to maintain full production. Drafts drawn by the producers on the government and deposited by the banks which discounted them were the guarantee for the issue of fiscal bills.[6] This assistance assumed an eventual increase of nitrate sales which, unfortunately, did not occur. There resulted a series of annual deficits in the government finances. So the interested parties took thought as to what could be done to save the companies' and the government's revenue.

The salvage problem was not easy. Production was erratic, varying between about 1,500,000 tons and 3,000,000 tons annually. Although there were some 140 separate nitrate plants, there were years when only 43 were operating. The others did not go out of business entirely but clung on waiting for the occasional spurt in exports. There was great variability in employment which ranged from about 30,000[7] to 60,000 workers. Because of the location of the nitrate pampas in the desert district of northern Chile, there was no great mobility of labor. When the laborers got there they tended to stay on. The deposits of caliche, from which nitrate is obtained, varied greatly in accessibility and work-

[4] Martner, *op. cit.*, pp. 629–35.

[5] R. H. Whitbeck, *Economic Geography of South America* (New York, 1926), p. 171.

[6] F. W. Fetter, *Monetary Inflation in Chile* (Princeton, 1931), pp. 138–39, 147–49.

[7] In 1934 only 10,000 laborers were employed. Whitbeck, *loc. cit.*, emphasizes the erratic nature of the industry.

ability, and great differences in costs consequently prevailed. About 25 to 30 per cent of the total nitrate was lost in the process of recovery. There were further difficulties due to the fact that there was British, German, Spanish, and American, as well as Chilean capital, in the industry. Not only did these various groups have different ideas as to how business should be run, but they brought with them different technical equipment for the productive process.

The various companies thought it would be an improvement if an association were organized to set prices and present a united front to competition from abroad. The government was willing to sanction the scheme when increased revenue was promised. On July 2, 1919, and again on February 10, 1921, the Chilean Nitrate Producers' Association was approved by the government. The nitrate companies were to establish prices at a level which would bring profits to most of the companies. There was some discussion about the prices agreed on. The government thought they were excessive. Some of the companies considered the prices too low. The government was to obtain its revenue by an export tax of 56 cents per 100 pounds of nitrate, the tax to be assessed regardless of price.

The scheme did not work too well. Since the quotas of sales assigned to the various companies were based on productive capacity, each company tried to increase its capacity. And those companies that could not operate at the prices fixed were permitted to sell their quotas to the low-cost firms at the rate of $6.00 per ton. This merely accentuated the previous difficulty of excessive productive capacity. It is true that production decreased somewhat, but exports decreased even more. This did not please the government.[8]

The low-cost firms wanted greater exports. The government agreed and argued that lower prices would increase consumption, and incidentally government revenue. Some of the companies were making rather large profits. According to a government investigation, certain nitrate plants received as much as 50 per cent

[8] On these efforts at control see B. B. Wallace and L. R. Edminster, *International Control of Raw Materials* (New York, 1930), chap. ii.

profits on their invested capital. This did not satisfy all the firms, and, besides, there was a rapid increase of nitrate stocks on hand. There was so much dissatisfaction with the arrangement that restriction was abandoned in February, 1927.

When restriction was abandoned nitrate prices fell, production and exports increased. This satisfied the government but not the business men. The dissatisfaction resulted in the organization of a new nitrate monopoly in August, 1928. This time the selling combine was empowered to fix prices for each large consuming center in relation to the competitive conditions in such centers instead of maintaining a single price for all nitrate sales. "Whatever the prices quoted in a particular market, the government guarantees to each producer who sells in that market, within the quota allotted to him, a price equivalent to 17 shillings per metric quintal, at the port of embarkation."[9]

In spite of the new organization, production still increased, although not quite so much as exports. But a great deal of the exported nitrates remained unsold as a part of foreign stocks. Neither the government nor the producers could tolerate the thought of completely uncontrolled price competition with foreign producers of nitrate. But price maintenance did not solve the problem. Production could not be effectively restricted because quotas were based on productive capacity. In order to get a larger quota each company increased its capacity. This resulted in increased nitrate stocks. There were too many producers with widely different costs for the restriction to succeed. But for the same reason, no other plan could be adopted.

The next suggestion was to have the same type of restriction, but on a bigger scale. In June, 1929, an agreement to restrict production was announced which included not only the Chilean producers but also the British and German producers of synthetic nitrates. It was impossible to allocate quotas in a way that would effectively restrict production and at the same time satisfy all the various companies. Consequently the arrangement was not successful.

By the time the next suggestion for a Chilean nitrate monopoly

[9] Wallace and Edminister, *op. cit.*, p. 53.

was advanced the competitive situation within Chile had changed. The Anglo-Chilean Consolidated Nitrate Corporation and the Lautaro Nitrate Corporation, each controlled by Guggenheim Brothers, had attained a dominant position in the Chilean nitrate business. After 1930 these companies became the strategic factors in any new nitrate monopoly. A summary of these companies' trials and tribulations is necessary in order to understand the difficulties of the later efforts to organize a nitrate monopoly.

The Guggenheims had been interested in the Chilean copper industry for many years. Only in 1924 did they turn their attention to nitrates. In September of that year they bought from the Chilean government, for $3,346,500, the Coya Norte lands, which comprised thirty-five square miles containing nitrate reserves of about 5,600,000 tons. On December 22, 1924, the Anglo-Chilean Consolidated Nitrate Corporation, with a charter of perpetual duration, was organized in the state of Delaware by the Guggenheims. The corporation took over the Coya Norte nitrate lands. The Anglo-Chilean Corporation then issued $10,000,000 of 7 per cent preferred stock (par $100) and 1,599,990 shares of no-par common stock (there were ten additional incorporators' shares). The issued stock was turned over to Guggenheim Brothers for "properties, rights, and processes" acquired from them.

In January, 1925, the corporation bought all the assets of the Anglo-Chilean Nitrate and Railway Company (Ltd.), an English company which owned nitrate properties adjacent to the Coya Norte lands, water and port concessions, and a railway connecting the nitrate properties with the port of Tocopilla. The assets of the English company, which was capitalized at £900,000, were acquired by the Anglo-Chilean corporation for 7 per cent first mortgage debenture stock valued at £3,600,000. After the purchase of the English company, the capitalization of the Anglo-Chilean Corporation was as follows: £3,600,000 ($17,518,500) 7 per cent first mortgage debenture stock, $10,000,000 preferred stock (par $100), 1,600,000 shares of no-par common stock.

On November 4, 1925, $16,500,000 of twenty-year 7 per cent sinking fund debenture bonds were issued. The proceeds of the bond sale were to be used for: " . . . . the purpose of completing

the construction and equipment of the company's new plant . . . . ; and for the purpose of reimbursing the company for past capital expenditure by retiring, or reimbursing the company for the cost of retiring, at not to exceed par, the company's heretofore issued and outstanding 7 per cent preferred stock." The remaining proceeds were to be used to electrify part of the railroad and any residue was to be used for "general corporate purposes of the company."[10] Lehman Brothers, Blair and Company, and Goldman-Sachs Company handled the bond issue. At the same time 156,770 additional shares of common stock were issued for cash.

The retirement of the preferred stock reimbursed the Guggenheim Brothers for their $3,346,500 purchase of the Coya Norte fields and left them with $6,653,500 besides. With their common stock they retained control of the company. At the time profits for some of the nitrate companies were high. But by 1926 the production and consumption of synthetic nitrates were running far ahead of the Chilean product.[11] The Guggenheims had promised a new process of nitrate recovery, an adaptation of the Guggenheim copper-leaching process, which, it was hoped, would increase the recovery of nitrate in the ground by over 30 per cent and

[10] See the prospectus of the bond issue published in Part II, pp. 547 ff., of *Hearings before the U.S. Senate Committee on Finance, 72d Congress, 1st Session, on the Sale of Foreign Bonds or Securities in the United States* (1931–32), hereinafter referred to as *Senate Hearings*.

[11] The competitive position of Chilean and synthetic nitrogen is shown for the later years. This situation was used by Guggenheim representatives as an argument for adoption of the Guggenheim process, and later also as an argument for the "rationalization" of the industry.

WORLD PRODUCTION AND CONSUMPTION OF NITROGEN*
In thousands of tons of pure nitrogen

	1913	1926/27	1927/28	1928/29	1929/30	1930/31	1931/32
Production:							
Synthetic	430	1,065	1,434	1,623	1,740	1,444	1,384
Chilean	440	200	390	490	464	250	170
Total	870	1,265	1,824	2,113	2,204	1,694	1,554
Consumption:							
Synthetic	.....	1,037	1,251	1,453	1,587	1,377	1,422
Chilean	.....	275	391	419	364	244	138
Total		1,312	1,642	1,872	1,951	1,621	1,560

* Peter Haller, "Artificial Fertilizers," Svenska Handelsbanken *Index*, VIII (October, 1933), No. 94

reduce the cost of recovery by about 40 per cent per ton. The process was patented in the Republic of Chile and turned over to the new corporation. The promised economies of the new process made the promoters extremely optimistic about future profits. Their optimism was reflected in the capitalization of the corporation.

There has been some controversy about this new process. The economies it offers are derived from the large-scale and continuous operation of the nitrate plants. It also makes possible the working of a slightly lower grade of ore (caliche). Under the old, or Shanks, process the caliche is pulverized in crushers and dumped into huge vats. When water is turned into the vats and heated, the earth sinks to the bottom and the water containing nitrate of soda along with some other chemicals is drawn off. This process is repeated until most of the impurities have been removed. The water containing the nitrate of soda then goes to the crystallizing tanks where, as the water cools, the nitrate is precipitated into crystals. The nitrate drys in the desert heat and then is packed into sacks for shipment.

The Guggenheim process has increased mechanization. Steam shovels load the caliche into cars which are hauled by electric locomotive to the crushers. Heavier and more crushers are used than with the Shanks process. After the caliche has been pulverized it is carried on a conveyor belt to the vats. The water or "mother liquor" is turned into the vats and conducted through four vats in the same process. The liquor is treated chemically to facilitate the separation of the nitrate from other chemicals. The crystallization process is speeded up by using compressed ammonia to cool the solution. Diesel engines run the generators which supply the electric current. The exhaust from the engines is used to heat the mother liquor. The aim of the process is to reduce labor costs and increase recovery of nitrate by the greater use of mechanical and chemical processes.[12]

The process was expensive to instal. The Pedro de Valdivia

[12] The process was described to the author at the Maria Elena nitrate plant in northern Chile. See for further details a description in *The West Coast Leader* (Lima, Peru), January 24, 1933, p. 11; January 31, 1933, p. 7.

plant cost about $30,000,000, while the Chacabuco plant using the Shanks process cost about $5,000,000. The greater capacity of the Pedro plant was supposed to offset its greater construction cost. The new process was less expensive to operate only if production could be maintained fairly near capacity. This might have been done if "other things remained the same." The other things which failed to remain the same were other Chilean producers who insisted on staying in the business with the old process and the foreign market which was not always willing to take Chilean nitrates.

The optimism of the promoters about the new process was not justified. The Anglo-Chilean Nitrate and Railway Company (Ltd.) had paid dividends for the five years preceding its acquisition by the Anglo-Chilean Consolidated Nitrate Corporation. No dividends were paid by the new corporation. After allowance for depreciation, depletion of reserves, and interest payments the Anglo-Chilean Corporation had a deficit of $203,092.47 on December 31, 1925.[13] In five years this deficit increased to $10,000,000. The bond issue, after the retirement of the preferred stock, was not sufficient to pay for the new nitrate plant. Guggenheim Brothers advanced $28,500,000 (including interest) in order to finish the construction of the new nitrate plant. This advance was assumed as a debt of the nitrate monopoly which was later organized in Chile.

In spite of the poor showing of the Anglo-Chilean corporation, the Guggenheims found the new nitrate process a readily capitalizable commodity. They proceeded to acquire another nitrate company which would use the new process. The Guggenheims proposed to the Lautaro Nitrate Company, English controlled and the largest producer of Chilean nitrate, that it should construct a plant for the use of the new process. The Guggenheims offered their patents and advice in installing the plant for a commission of £100,000.[14] The Lautaro Company was capitalized at £8,000,000 (1,600,000 shares of stock at £5 each). In relation to

[13] See record in above quoted prospectus in *Senate Hearings*, Part II, p. 560.

[14] See prospectus of bond issue and history of the company in *Senate Hearings*, Part II, pp. 580 ff.

the capitalization, the commission requested did not seem excessive. But the Guggenheims took their commission in voting stock to the extent of 2,000,000 shares valued at a shilling a share. In this manner £100,000 controlled the entire company. The control was then pyramided by organizing the Lautaro Nitrate Corporation of Delaware (U.S.A.). This corporation took over the 2,000,000 controlling shares in the Lautaro Nitrate Company. The Corporation then issued 4,000,000 shares of no-par common stock, of which 2,441,668 shares (61 per cent of the total amount issued) were turned over to the Anglo-Chilean Consolidated Nitrate Corporation, which in turn was controlled by Guggenheim Brothers. The details of the process by which the Company was acquired on such favorable terms have not been revealed. Promises of economies from the new nitrate process seemed to be an unusually powerful weapon.

Money for the construction of the new plant was obtained by a bond issue of $32,000,000. Bonds to this value were turned over to the National City Company of New York, in exchange for $30,000,000 plus interest accrued to the date of delivery. Six hundred thousand shares of Lautaro Nitrate Corporation stock went with the bonds.[15] Each $1,000 worth of bonds was accompanied by a warrant entitling the holder to receive on January 1, 1930, without cost, ten shares of common stock of the Lautaro Nitrate Corporation. In addition each $1,000 of bonds was convertible at the option of the holder into ten shares of cumulative preferred stock of the Lautaro Nitrate Company (Ltd.) and four shares of Lautaro Nitrate Corporation. These reserves required 448,000 shares of Lautaro Nitrate Corporation stock. There remained 152,000 shares of the original 600,000 shares turned over. This was a bonus to the National City Company. The other participators in the bond issue, J. P. Morgan and Company and Lehman Brothers, apparently were not aware of the National City Company's bonus. There remained 958,332 shares of Lau-

[15] The following details are from *Hearings before a Subcommittee of the Committee on Banking and Currency, U. S. Senate, 72d Congress, 2d session, on Stock Exchange Practices*, Part 6, pp. 2298 ff. Testimony of R. M. Byrnes of the National City Company.

taro Corporation stock, which may have been sold or issued to Guggenheim Brothers' participators.

The financial groups paid little heed to the precarious nature of the nitrate business. They argued that the new process would insure profits to the company. The assets, or a portion of them, of the Lautaro Nitrate Company were used to support the bonds in the market. The National City Company agreed to purchase the bonds, to a limit of $1,000,000, if they fell below the issue price during the following year. The Lautaro Company undertook to maintain a 27½ per cent margin and the National City Bank undertook to supply the remainder of the $1,000,000. The margin to be maintained by the Lautaro Company was later reduced to 10 per cent, since the company needed some of the cash. The bonds remained above the issue price until the stock market broke in October, 1929. Bonds were bought until the end of December and resold during March and April, 1930. The transaction resulted in a gross profit of $12,978.40, of which $1,516.75 was turned over to the Lautaro Corporation and the balance retained by the National City Company.

While the Guggenheims may have profited from their financial operations, their nitrate companies did not thrive. The world-wide economic depression made things worse. The Chilean government was being deprived of the major part of its revenue and found it difficult to meet service requirements on the foreign debt. The Guggenheim representatives thereupon claimed that the full advantages of the new nitrate recovery process could not be realized unless the industry were thoroughly "rationalized." Production should, therefore, be more fully allocated to the Guggenheim plants, the small companies to be compensated by stock in a new corporation.[16] The government was only too willing for some arrangement which would revive the industry, and the smaller producers were threatened with extinction if they did not come to terms with the Guggenheim companies.

After prolonged negotiation a law was passed July 21, 1930,[17]

[16] See an article on "Nitrogen" in *Fortune*, II (October, 1930), No. 4.

[17] The history of the formation of Cosach is told in a report by the Chilean Committee to Investigate the Acts of the Dictatorship reprinted in *Senate Hearings*,

officially establishing a new nitrate monopoly, Compania Salitre de Chile, or "Cosach" as it was called. The capitalization was to be 3,000,000,000 pesos legal currency divided into shares of 100 pesos each. The government was to receive the A shares having a total value of 1,500,000,000 pesos. The B shares to a value of 1,500,000,000 pesos were to go to the industrialists in exchange for the shares in nitrate companies joining the new organization. Part of the B shares were preferred 7 per cent cumulative shares. These were not to exceed in value 500,000,000 pesos of the B shares. An amortization fund was set up to retire the preferred shares. It was further provided that in case the capital of the company was increased the number of A shares should remain equal to the number of B shares. The A shares would be represented by four directors in the company, the ordinary B shares by seven, and the preferred B shares by one.

In exchange for the A shares the government renounced all export duties on nitrates and iodine produced by the company. These duties had brought the government an average of upwards of $30,000,000 for the three years preceding 1930.[18] The government also delivered to the company nitrate reserves up to 150,000,000 tons. These reserves were to be exempt from the land tax. The leasing of reserves and land taxes had preciously been a source of government revenue. To compensate the government for the loss of export duties while the company was getting started, it was to pay the government the following sums: in 1930, 186,000,000 pesos; 1931, 180,000,000 pesos; 1932, 160,000,000 pesos; and in 1933, 140,000,000 pesos. The Chilean peso was figured at approximately $0.12. The amount of export duties collected from companies not belonging to Cosach was to be credited against these sums.

The government was persuaded that it would gain more by a claim to 50 per cent of the profits than it would by collecting export taxes. The "rationalization" of the industry would inevita-

Part 4, pp. 2050 ff., 1932. The law establishing Cosach is to be found in *Diario Oficial* of the Republic of Chile, No. 15728, of Monday, July 21, 1930; Law No. 4863. Translation in *Senate Hearings*, Part 4, p. 2069.

[18] *Commercial and Financial Chronicle*, 131 (1930), 3636.

bly bring profits. The government representatives were well paid for their work in organizing the new company. A total of 1,654,194 pesos was paid to various public officials. This was a small sum, however, compared to the payments made to lawyers representing the nitrate companies. Carlos Castro Ruiz was appointed minister of finance on January 9, 1931, and as such approved Cosach plans for bond issues and for changing the payments to the government from cash to bonds. His zeal in working for the Cosach organization may have been heightened by the fact that he was a director of the Lautaro Nitrate Company (Ltd.) and was the Chilean manager of the Anglo–South American Bank, which had extended large credits to various nitrate companies and was to extend still further credits to the new nitrate monopoly.

It will be remembered that in previous efforts to create a Chilean nitrate monopoly difficulties developed over the allocation of production as between the high-cost and low-cost firms. Under the new arrangement the high-cost firms were to stop production and output was to be assigned to the new Guggenheim process plants. The other firms were to transfer their debts to Cosach and receive stock in exchange for their assets. This encouraged the companies to exaggerate the value of their businesses.

The Anglo-Chilean Corporation received four shares of Cosach for each share of Anglo-Chilean stock.[19] A total of 8,318,335 shares of Class B common stock was turned over to the Anglo-Chilean Corporation. Of this amount 4,900,000 shares were for the assets of the Anglo-Chilean Corporation. The remaining shares were given to the Anglo-Chilean Corporation for its 61 per cent control of the Lautaro Nitrate Corporation which controlled the Lautaro Nitrate Company (Ltd.). There remained 779,166 shares of common stock in the Lautaro Corporation. These were transferred to Cosach in exchange for 3,181,665 B common shares. These shares were distributed pro rata to the stockholders of the Lautaro Corporation and that corporation was dissolved. This

[19] *Senate Hearings*, Part 4, pp. 2059 f.; Moody's *Manual of Investments, Industrials* (1931), p. 2887. The actual exchange of stock between Cosach and the Anglo-Chilean was made through the Compania Salitrera Anglo-Chilena, a Chilean incorporated company to which was assigned the assets of Anglo-Chilean. It was still controlled by Guggenheim Brothers.

exchange might seem a bit generous, since the Anglo-Chilean Corporation had a deficit of $10,000,000 and the Lautaro Corporation had a debt of $28,500,000 to Guggenheim Brothers which was not yet taken care of. Although it was controlled by the Guggenheims, Cosach dealt liberally with the other nitrate plants. The government valuations of some of the companies were higher than the valuation revealed in the financial statements of the companies themselves. Thirty-four companies joined Cosach, and received mainly preference shares. The terms of exchange with Cosach of a few of the companies are listed in Table I.[20]

TABLE I

	Nominal Value of Shares	Dividend Percentage Last Fiscal Year	Stock Exchange Quotation—London		Amount Cosach Offered in Exchange	
	s.		*s.*	*d.*	*s.*	*d.*
Angela Nitrate	20	10	..	..	60	0
New Tamarugal	20	nil	10	..	24	9
Santa Catalina	20	nil	..	..	6	3
Aguas Blancas	5	nil	3½	..	..	11½
Rosario	20	nil	4	6	11	6
Lagunas	20	nil	1	6	5	8
San Sebastian	20	nil	..	6	1	6
New Paccha and Jazpampa	20	nil	80	..	86	6

Cosach lacked money and something had to be done about the debts of the constituent companies. Various bond issues were resorted to. The first issue consisted of $50,456,500 of prior secured sinking fund 7's. These had first claim on the export taxes. About $34,000,000 of this issue were publicly sold—$19,000,000 in the United States through the National City Company; $10,000,000 in London, sold mainly to insurance companies and trust companies; $5,000,000 in Holland, Sweden, and Switzerland.[21] The proceeds of this issue were to be used to pay a $21,900,000 guaranty to the Chilean government and the expenses of organizing

[20] *Economist*, Vol. 112, Part 2 (April 4, 1931 [London]).

[21] *Economist*, Vol. 112, Part 2 (April 4, 1931); *Commercial and Financial Chronicle*, Vol. 132 (April 4, 1931). It was reported in New York that Guggenheim Brothers would purchase $10,000,000 of this issue. *New York Herald Tribune*, April 12, 1931.

Cosach. The expenses totaled about $6,000,000. Approximately $1,000,000 was paid to lawyers, particularly the firms of Root, Clark and Buckner, of New York, and Sherman and Sterling. Another large expense item was the compensation to certain agencies, or representatives of nitrate companies, such as W. R. Grace and Company, and Buchanan, Jones and Company, who had to be compensated for losing their agencies. The total organization expenses exceeded the amount authorized by about $4,000,000. The part of the issue that was not publicly sold was reserved for the acquisition of the assets or shares of the nitrate companies.[22]

The second issue was authorized for tax payments due the Chilean government in 1932 and 1933. Originally these payments were to be in cash but the law establishing Cosach was changed permitting payments in bonds. The issue totaled $70,000,000 of secured sinking fund 7's. This issue had a second claim on export taxes. Of the proceeds of this issue, $40,149,000 were to go to the government for the tax payments, and the balance was to be used to satisfy certain obligations due nitrate companies and for other "corporate purposes."

Besides the above issues, there remained $79,650,000 of constituent companies' (mainly Anglo-Chilean and Lautaro) bonds outstanding. Net earnings were to be used for service on these bonds.

It is interesting to note that the Guggenheims had their advance to the Lautaro Company taken over by Cosach ahead of the previously issued Lautaro bonds. In fact all of the bonds issued by Cosach came ahead of the Lautaro bonds. The Lautaro bondholders did not like the arrangement, but they did not succeed in changing it.[23] Another aspect of the arrangement was that the bonds received by the Chilean government were mostly not of the Prior Secured series. The Prior Secured bonds that were not publicly sold went to the industrialists. The funded debt was a heavy burden for the new nitrate monopoly to bear. As was pointed out at the time of the investigation of the Chilean Nitrate

[22] For the organization expenses, see *Senate Hearings*, Part 4, p. 2062.

[23] *Economist*, Vol. 113, Part 1 (August 22, 1931).

Company, its debts were more "than the total external debt contracted by Chile from the time of its independence up to the year 1927, the first of the Ibanez dictatorship," [24] i.e., were more than the amount of the Chilean external debt outstanding in 1927.

In the financial statement of Cosach, the assets had to be carried at a very high figure to cover the liabilities. The Cosach financial statement for March 20, 1931, reveals that out of total assets valued at $758,000,000, some $540,000,000 were represented by nitrate reserves valued at 17.50 Chilean pesos per ton. The London *Economist*[25] pointed out that this was equivalent at par to 10½*d*. per metric quintal as compared with 4½*d*. per metric quintal paid by the Lautaro Company for large purchases of nitrate reserves from the government in 1929. Some of the government advisers said the reserves should be valued at 10 pesos per ton. This opinion was overruled by A. E. Cappellen-Smith, Guggenheim representative, who insisted that the nitrate reserves were now worth 17.50 pesos per ton, since they were to be used in the new Guggenheim recovery process. Since this process recovered a greater proportion of the nitrate than the old process had, it followed that the reserves were more valuable. The superior virtues of the new process had yet to be demonstrated. Under this principle of capitalizing economies, the main effect of "improvements" is to increase debt.

Under the Cosach organization the nitrate industry was faced with its usual difficulty, namely, too much capacity. The difference under the new arrangement was that all the ownership claims represented by the various nitrate plants had been transferred to Cosach and were represented by stocks and bonds. Even if all the Shanks process plants ceased operation, it seemed highly questionable if enough profits could be made to meet all the obligations that had been assumed by Cosach; and in so far as the Shanks plants did not disappear nitrate capacity was greater than it had ever been. It did not seem likely that the nitrate market would expand at all proportionately to the claims placed on Cosach.[26] Peter Haller[27] pointed out that even if the anticipated sales of

[24] *Senate Hearings*, Part 4, p. 2055.

[25] August 22, 1931.

[26] *Fortune, loc. cit.*

[27] *Index, loc. cit.*, p. 211.

nitrate in 1931–32 had been estimated at $40,000,000, a rather high estimate, the net receipts from the sales would not have been sufficient for service of the debt, which amounted to $257,000,000.

For the promoters of Cosach the picture was brighter. Guggenheim Brothers had acquired control of the industry, had secured a preferred position for their own credits to nitrate businesses, and had virtually made the government pay the expenses of the organization. The Chilean government was not so fortunate in the new organization. Prior to the organization of Cosach, the government received its export taxes before any other obligations were paid. Miguel Cruchaga, Chilean ambassador in Washington, in testifying about Cosach said: "The previous export duty was collected by the customs service as a state tax, and the present assessment is received by the bankers representing the bondholders."[28] The government did participate in profits, if any were earned. But it had relinquished its position as prior claimant on the proceeds of nitrate exports.

The depression deepened, nitrate exports decreased, and new borrowing from abroad was impossible. Advances were made to Cosach by the government institutions, the *Central Bank of Chile* and the *Institute of Industrial Credit*, but these could be only temporary aids. The Chilean government defaulted on its external debt during 1931, and the bonds of Cosach along with those of the constituent companies went into default. The private business interests in Cosach blamed general conditions for the failure of the organization. They said, "Many believe that Cosach would have succeeded under normal conditions."[29]

Political changes followed the economic debacle in Chile. Carlos Ibanez, the dictator, lacking revenue, was unable to maintain his political following. He was overthrown by a conservative régime in August, 1931, which was in turn displaced in June, 1932, by Carlos Davila, who promised a socialist government. A month later Colonel Marmaduque Grove seized power, only to have his "communist régime" crushed by Davila. Revolts were chronic

[28] *Senate Hearings*, Part 4, p. 2047.

[29] *Memorandum, Bondholders' Protective Committee*, Lautaro Nitrate Co. (Ltd.), New York, October 10, 1934. Issued at the office of A. J. Accola, New York City.

until in October, 1932, Arturo Alessandri, a lawyer and former president of Chile, was elected president.[30] He was no radical, but the political pressure for reorganization of the nitrate industry in favor of Chile rather than of foreign interests was so great that he was forced to consider some new arrangement for nitrates.

The failure of Cosach was greater than had been anticipated. The net loss after fixed charges for the year ending June 30, 1932, was $13,385,406. Only 1,065,800 tons of nitrate were produced in 1931–32. Stocks of nitrate on hand as of June 30, 1931, were 1,638,278 tons and on June 30, 1932, were 1,764,610 tons. Employment was very low. Cosach employed 18,945 workers in 1931 and 10,569 in 1932.[31] The unemployment further added to the government's anxiety to do something about nitrates, since there were numerous labor revolts in the northern provinces.

It was not difficult to find reasons for reorganizing the nitrate monopoly. Liquidation of Cosach was decreed by the Chilean government, January 2, 1933. It was stated that the law establishing Cosach had been violated in the following particulars:[32]

1. The value of shares issued exceeded the 1,500,000,000 pesos authorized by more than 400,000,000 pesos.

2. Article 11 of the Cosach law, which stated that the nitrate reserves should be turned over to the company as the company may "need and request them," was not observed. The reserves were turned over without showing need.

3. Article 19, which stated that the "administration of the company shall rest exclusively with the Board of Directors," was violated because the company was administered by a foreign group.

4. The representatives of series A shares could overrule the Board of Directors in any "matters of national importance." The

[30] See *Foreign Policy Reports* Vol. IX, No. 25 (February 14, 1934), "Chile Struggles for National Recovery," for a general review of Chilean conditions during this period.

[31] Moody's *Manual of Industrials*, 1933, p. 1949; *New York Times*, April 1, 1933, 30:4.

[32] *Anexo al boletin mensual*, Banco Central de Chile, Santiago (July, 1933), "Legislación salitrera, Decreto No. 1, dispene la liquidación de la compania de salitre de Chile."

present emergency was a matter of national importance, so the government could take charge.

The business men were not unwilling to see someone attempt to unscramble the mess. A liquidating commission was appointed and a plan for reorganization originally advanced by Finance Minister Gustave Ross was eventually presented and made law on January 8, 1934. The problem for the commission was exactly the same as the nitrate problem had always been, namely, to get increased revenue for the government and still satisfy the ownership claims against the nitrate monopoly.[33] There were four members of the liquidating commission appointed, respectively, by the Supreme Court of Chile, the president of Chile, the preferred shareholders of Cosach, and the ordinary B shareholders.

The commission had to operate the industry while it was being reorganized. The first efforts were to try to stir up some new nitrate markets so that the reorganization would not have to be too drastic. This sales pressure abroad was slightly successful. The Hawaiian market was regained, although it did not amount to much. The Chileans broke away from the European nitrate cartel and increased sales slightly by lowering prices. The by-products of nitrate, iodine and sodium sulphate, were pushed, and chemists were put to work trying to find new uses for nitrates. But it was not found possible to increase sales substantially. The commission, however, did not think it expedient to decrease production, on account of the political situation. Unemployment was a very serious problem and might lead to the overthrow of the Alessandri régime. In the nitrate fields there were no other industries to fall back on, and food, having to be imported from southern Chile, was very expensive. As a result labor riots were chronic. In order to help the employment situation, the commission called for the export of 300,000 additional tons of nitrate

[33] The story of the liquidation and reorganization is taken from the reports of the Comisión Liquidadora de la Compania de Salitre de Chile; *Memoria presentada a los accionistas preferidos en la Junta General celebrada el 15 de Junio de 1934; Exposiciones a las Juntas de acreedores celebradas el 15 de Junio de 1934;* Corporación de ventas de salitre y yodo de Chile: *Ley, estatutos, reglamentos, cesion del estanco, adhesiones, primer directorio* (Santiago, 1934).

in the first half of 1933. In the previous semester only 26,000 tons had been exported. With the increased export unsold nitrate stocks in Europe and Egypt were 189,137 tons and in the United States 119,264 tons. Such was the situation June 30, 1933. This situation gave little comfort to the creditors of Cosach. Furthermore, these stocks abroad could not be sold so rapidly as greatly to reduce the price, since they were the security for a $350,000,000 credit extended to Cosach by London and New York bankers for financial requirements from June 30, 1932, to June 30, 1933.[34]

The commission tried to aid employment further by spreading production to a larger number of plants. Three or four small *oficinas* were revived. Guggenheim Brothers did not operate their new Guggenheim process plant, but spread their output among some fifteen plants in order to spread employment and keep the ports of Antofagasta and Taltal alive. Perhaps altogether some 2,000 additional men were employed by these maneuvers. The situation was not greatly improved. The government borrowed 6,000,000 pesos from the Central Bank of Chile with which to ship the unemployed workers from northern Chile to farms in southern Chile. The nitrate workers were not highly successful as farmers. The main change in the situation was that the government debt increased and the labor disturbances were transferred from northern to southern Chile.

As part of the process of liquidating Cosach, the 15 million series A ordinary shares that had been issued to the state, and the secured bonds (about $40,000,000 worth) held by the government were destroyed. The state, however, was to receive 140,000,000 pesos ($17,500,000) in compensation for the fiscal year 1933, and the fiscal nitrate reserves were removed from the control of Cosach.

The $50,456,500 Prior Secured Bonds (7 per cent) of Cosach were to be replaced by a new issue of 6 per cent bonds, not to

[34] Moody's, *op. cit*, 1933, p. 1951. A treaty was later signed with Germany whereby Germany agreed to take in exchange for certain German goods 106,000 tons of Chilean nitrate between January 22 and June 30, 1943, *Boletin mensual*, Banco Central de Chile, No. 71 (January, 1934).

exceed $52,000,000, with prior claims on profits if any were made. Of this issue $3,000,000 were to be given to the Anglo-Chilean Corporation in cancellation of a loan made to Cosach in the period December, 1931, to March, 1932.

The 10,500,000 ordinary B shares of Cosach which had been turned over to the Anglo-Chilean and the Lautaro Corporations were canceled, and these companies were separated from Cosach and reassumed the obligations of their own bonded indebtedness.

The thirty-four so-called independent companies were grouped into a new corporation called Compania Salitrera de Tarapaca y Antofagasta. This company was to issue shares to a value of 209,000,000 pesos in exchange for the 418,495,600 pesos worth of shares which the thirty-four companies had held in Cosach, and to assume its own obligations. The creditors of the company, including bondholders, were to be paid pro rata from the proceeds of the sale of stocks of nitrate held by the company in Chile. In the Cosach organization these debts had been represented by $10,287,125 (United States) of secured bonds.

The Chilean government was the main loser in this arrangement, since its Cosach secured bonds were canceled, while the remainder of the secured bonds were made an obligation of the constituent nitrate companies co-ordinate with the claims listed above. The security of the bonds was to be changed from the export tax to the sale of nitrate stocks. The government did hold some of the prior secured bonds, the service on which had first claim on profits. But the government received nothing from the sale of existing nitrate stocks.

A sales corporation was established to handle the sale of nitrate and iodine, which it buys from the three companies, namely, the Lautaro Nitrate Company, the Tarapaca and Antofagasta Company, and the Anglo-Chilean Consolidated Nitrate Corporation. The first proceeds of sales were to go to the Central Bank of Chile, which had advanced credits to the sales corporation. The corporation was to take over also the $350,000,000 which had been advanced to Cosach by New York and London bankers to meet

financial requirements in the year June 30, 1932, to June 30, 1933. These debts were to be liquidated by the sale of nitrate stocks abroad. The companies that had nitrate stocks on hand within Chile were to receive for them £3 per ton provided that this price was not higher than the sales price.

The corporation was to buy new nitrate production at a price sufficient to cover the industrial cost alongside ship plus $1.50 per ton. Any part of the $1.50 which was not used by the companies in the improvement of their own plants was to be turned over to a general fund for nitrate exploitation.

The quotas assigned the various companies were, as in the previous nitrate schemes, based on productive capacity, but with a maximum quota for any company of 65 per cent of the annual quota for all companies. The nitrate sold was to be supplied from the total nitrate stocks on hand to not less than 20 per cent or more than 30 per cent of the total sales. Quotas for the first five-year period were fixed as follows:

	Per Cent
The Lautaro Nitrate Company (Ltd.)	36.00574
Cia Salitrera de Tarapaca y Antofagasta	31.03943
Cia Salitrera Anglo-Chilena[35]	26.07312
Others	6.88171
	100.00000

The position of the Guggenheim companies as regards their share of Chilean production was about the same as before the organization of Cosach. The two Guggenheim companies received 62 per cent of total production as their quota. However not all of this production was directed to the new Guggenheim process plants. For the sake of employment it was spread among some of their old Shanks process plants. As late as October, 1934, the Pedro de Valdivia, the most modern Guggenheim process plant, was still closed down. The industry was about as far from "rationalization" as it always had been.

The profits of the nitrate companies under control of the sales

[35] See footnote 19 for relationship of this company to the Anglo-Chilean Consolidated Nitrate Corporation.

corporation were to be the difference between the price paid the companies for their nitrate and the sales price, less the expenses of the sales corporation. Of these profits 25 per cent were destined for the state (5 per cent of this for the development of mining and industry in Tarapaca and Antofagasta) and 75 per cent for the nitrate companies. The profits were to be assigned in proportion to sales quotas. The first charge on these profits was for the service of the bonds. The profits were exempt from the income and export taxes. During 1933 the companies were to pay 140,000,000 pesos to the state. There actually were profits in 1934. The government is even contemplating renewing service on its foreign debt due to the fact that nitrate sales have increased.[36]

The industry as a whole does not seem to be much better organized than before. Productive capacity and unsold stocks of nitrate have increased. The government's revenue is still in a precarious position. However Guggenheim Brothers do not seem to have lost money in the various permutations through which the industry has gone.

These financial activities of the people in the industry may best be viewed as a jockeying for position in the maintenance and extension of ownership claims. The "rationalization" of the industry was important in the main as a device which could be capitalized at an unusually high figure. It rested on an extremely roseate view of the future. Of course, such business optimism is not unusual. This optimism was so persistent that the Chilean government and foreign financiers advanced further credits to the nitrate companies in periods of stress with the result that there has been no effective scaling-down of ownership claims during depression. In fact, over a period of time there has been a tendency for these claims to increase. Consequently "costs" are so high that the industry has been placed in a precarious competitive position. This in turn decreases government revenue and increases government instability, even, at times, causing collapse. Government stability in Chile becomes a problem in corporation finance. Since it is impossible to scale down adequately the ownership claims

[36] *Boletin mensual*, Banco Central de Chile, No. 80 (October, 1934).

because of the political influence of their owners, the government throws its emphasis on trying to expand sales abroad and to develop new markets. But there is a limit to which this can be pushed in a world that is becoming increasingly nationalistic, especially since practically any country can manufacture its own nitrates if necessary. Preparation for war is the main factor in the recent increase of nitrate sales. The outbreak of war might create a very large market for nitrates, thus momentarily creating a prosperous situation. But this could not be relied on, since the warring powers would probably start making their own nitrates. Chile lost her best nitrate customer, Germany, because of the World War.

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THE TREND OF SAVINGS, 1900–1929

THE February, 1935, issue of the *Journal of Political Economy* contains an article by Dr. Clark Warburton in which he elaborates a summary criticism of a chapter on "The Trend of Savings, 1900–29" in *America's Capacity to Consume*, a book of which he is co-author. In view of the significance of the issue in question, a specific analysis of Dr. Warburton's data and methodology appears to be called for. In the following pages we shall reveal the fallacies in his method and assumptions. In so doing, we utilize his derived figures—from the *Journal* article—although we feel it necessary to emphasize that we consider these figures for years prior to 1929 to be highly unreliable.[1] However, when well-known statistical analysis is applied even to these figures, the results serve to support rather than to refute the conclusions reached by Doctors Moulton and Leven in *America's Capacity to Consume*.

Before proceeding to the appraisal of Dr. Warburton's article, the carefully worded conclusions of the book should be reproduced. The discussion of the trend of savings is broken under two subheads: (1) Individual Savings; and (2) Corporate Savings. The conclusion reached regarding individual savings is stated as follows (page 108):

> . . . . there has been a definite tendency for the percentage of the aggregate income which is saved to increase more or less continuously over the three decades (1900–29), but particularly during the post-war years. While one would not be warranted from the available data in making any precise estimate of the extent of the increase, the general tendency is unmistakable.

[1] Dr. Warburton's contentions were submitted before the book was published and were overruled by the committee as lacking validity. The method of estimating income distribution and savings for the years prior to 1929, such as he has employed in the article in the *Journal*, was considered, but rejected as unscientific. The 1929 data on savings and on income distribution are rough approximations at best, though useful and significant for the general purpose to which they were put. The use of such data as a basis for extrapolating annual figures for the fifteen or twenty years preceding 1929 inevitably yields untrustworthy columns of figures. It should be evident, as a matter of ordinary common sense, that the more one builds estimates upon estimates the less reliable becomes each set of resulting figures.

Regarding corporate savings, the conclusion stated is:

> We find no apparent tendency for corporations to retain as surplus an increasing percentage of their earnings as the years pass.

The summary paragraphs at the end of the chapter contain the following statement, with which Dr. Warburton begins his article, and against which he directs his criticism:

> From the analysis and data in the foregoing pages, it appears that the economic developments during the first three decades of the present century have not only increased the ease with which national savings may be made, but have in general speeded up the rate of savings. In the case of individuals the increase in national productivity has manifested itself, with certain interruptions, in a dual tendency toward an increase in the volume of savings relative to consumptive expenditures: the rise of incomes in general has made it possible for the population as a whole to save a somewhat greater proportion of their income; while the fact that there has been a greater increase in incomes received by the upper than by the lower income classes has tended automatically to increase the aggregate volume of savings. The tendency has been especially marked during the last decade.

It will be observed that no claim was made that there was a straight-line increase in the rate of savings throughout the three decades, unmarked by fluctuations incident to changes in business conditions. On the contrary, emphasis was laid only upon the general upward tendency from decade to decade and particularly during the post-war years. The conclusion was based primarily upon the showing that there has been a marked increase in the numbers of persons in the higher income brackets where the great bulk of the savings, according to Dr. Warburton's computations, occurred.

In the *Journal* article Dr. Warburton undertakes to supply the necessary data for showing definitely that the conclusions of the chapter are false, and in concluding the article he purports to have shown (page 101) that:

> In respect to the first decade of the century, included by Moulton and Leven in the period during which they contend that there has been an upward trend in the percentage of aggregate income saved, no significant evidence is available . . . . . between 1909 and 1929 . . . . there is no evidence of an upward trend in the percentage of aggregate income saved.

The data directly supplied by him are his own estimates of the aggregate income received and the amount saved *in the various*

income classes during the period 1914–28, and similar savings estimates for 1910. He obtains these figures by a methodology based on the assumptions (quoted here from pages 87 and 88–89 of the *Journal*):

> . . . . that annual estimates of the total amount of income received by families and unattached individuals *in the various income classes* may be derived from figures given for 1929 in *America's Capacity to Consume*, on the assumption that year-to-year changes in the aggregate income of families and unattached individuals *in the various income classes* are proportional to changes in the aggregate income of individuals in corresponding income classes as reported in *Statistics of Income*; . . . .
>
> . . . . that there were no changes in the proportions of income saved by those *in the various income classes*.

While he rightly attributes these assumptions to the authors of chapter ix, the interpretation he gives them is his own, and it is his interpretation of the second of these assumptions that involves him in the grossest errors of method and results.

By means of tools available to the beginner in statistical work, it will be shown that his interpretation of this assumption introduces an upward bias into his savings estimates. In short, his methodology tends to overstate the rate of savings for the years prior to 1929, the extent of the error increasing with the distance of the year of estimate from the base year 1929. Correction for this error would considerably lower his savings estimates for earlier years. In Section I below, the trend of savings is analyzed by a slight extension of the methodology utilized by Dr. Warburton; also, in Chart VII, a least-square line is fitted to the savings data presented by him. In all cases, the upward tendency is unmistakable. In Section II, the savings figures offered by him for the year 1910 are subjected to analysis and criticism, by means of which a rough indication is obtained of the extent of the error involved in his methodology.

I. EVIDENCE OF TREND, 1914–29

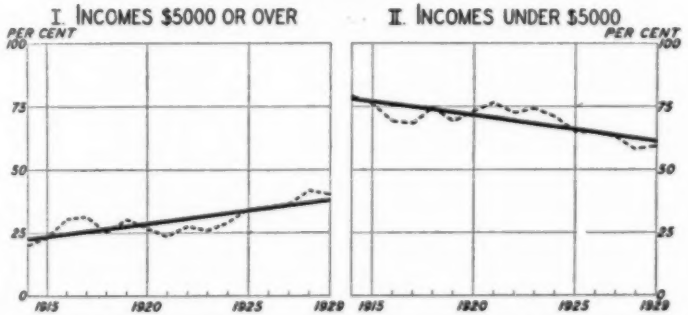
In this section an extension of Dr. Warburton's methodology is applied to the data used in his article, the purpose being to extract certain relevant information regarding trends in the distribution of income and in the rate of savings during the period

1914–29. No correction is made here for the biased error implicit in his interpretation of the assumption of " . . . . no changes in the proportions of income saved by those in the various income classes." The reason for this procedure is lack of necessary data—explained in more detail in Section III below. For the present it must suffice to repeat that, if a correction for this error could be made,[2] the trend in the rates of savings would be found to be much more sharply upward than is indicated in the charts below.

The information gained from this analysis is briefly summarized in the charts and text which follow, and the relevance of the information to the points at issue is indicated. Supporting tables are also given in so far as space permits. Tables omitted will be furnished on request.

1. In the period 1914–29, the proportion of national income received by those with incomes of $5,000 or over shows a marked

CHART I.—SHIFT IN THE DISTRIBUTION OF INCOME, 1914–29
(Percentage of aggregate individual income received by specified income groups; with least-square lines of trend)



Trend Lines: I. 1914 Value, 22.57; 1929 Value, 37.87; Annual Increase, 1.02.
II. 1914 Value, 78.13; 1929 Value, 61.45; Annual Decrease, 1.11.

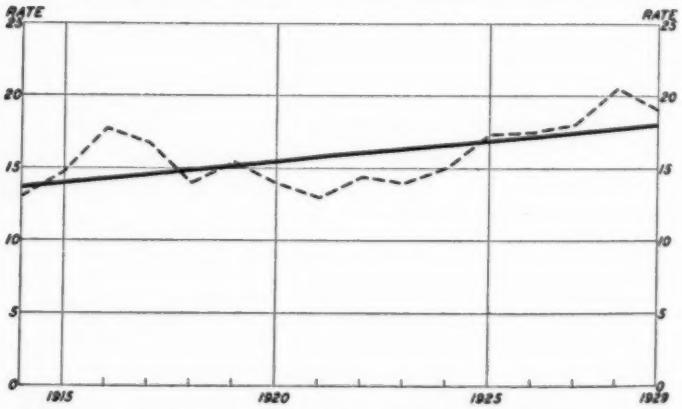
upward trend. The proportion received by the group below the $5,000 income level shows a corresponding downward trend. Data are presented in Chart I.

[2] A correction for this error would lower the savings ratios and the fitted line of trend, toward the left end of the range. This would follow for the income group under $5,000, shown in the second part of Chart III, as well as for all other income groups.

The importance of this shift in the distribution of income is apparent, since the greater the share received by those in the upper income brackets, the greater the savings. (This is shown, for example in Dr. Warburton's table in the February *Journal*, page 91, where *rates* of savings per income class increase sharply with increases in the amount of income received.) This shift in the distribution of income and its bearing on the question of savings was pointed out in the paragraph (from *America's Capacity to Consume*) against which Dr. Warburton directed his article.

2. During the same period, the proportion of aggregate income saved *by all individuals* also shows a marked upward trend. Data are presented in Chart II and Table I. This finding is in close

CHART II.—UPWARD TREND IN THE RATE OF INDIVIDUAL SAVINGS, 1914–29
(Individual savings each year as percentage of aggregate individual income)



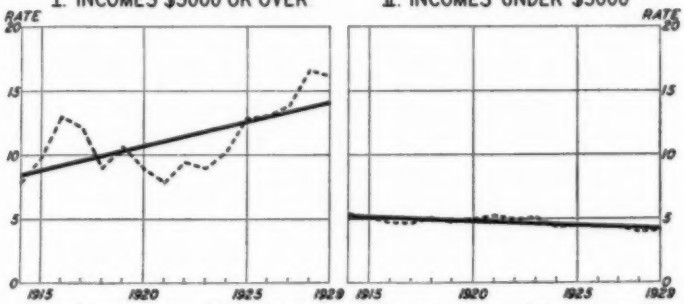
Trend Line: 1914 Value 13.69; 1929 Value, 18.07; Annual Increase, 0.29.

agreement with the conclusion reached in chapter ix regarding the trend in the rate of individual savings.

3. The upward trend in the rate of individual savings, shown above, is a direct result of the upward trend in the average rate of savings of the group with incomes of $5,000 or over. In fact, as shown above, the proportion of *aggregate individual* income saved by those with incomes below $5,000 has shown a slight tendency to decrease. Data are given in Chart III and Table I.

CHART III.—TRENDS OF SAVINGS RATIOS FOR UPPER AND LOWER INCOMES, 1916–29

(Savings of each group as percentage of aggregate individual income)



Trend Lines: I. 1914 Value, 8.37; 1929 Value, 14.07; Annual Increase, 0.38.
II. 1914 Value, 5.26; 1929 Value, 4.18; Annual Decrease, 0.07.

TABLE I. PORTION OF AGGREGATE INDIVIDUAL INCOME SAVED, 1914–1929[a]

YEAR	SAVINGS OF THE $5,000 OR OVER INCOME GROUPS		SAVINGS OF THE INCOME GROUP UNDER $5,000[b]		TOTAL SAVINGS, ALL INCOME GROUPS[b]	
	In Millions of Dollars	As Percentage of Aggregate Individual Income	In Millions of Dollars	As Percentage of Aggregate Individual Income	In Millions of Dollars	As Percentage of Aggregate Individual Income
1929...	14,932	16.1–15.9[b]	2,823–4,727	3.0–5.1	17,755–19,661	19.1–21.0
1928...	15,201	16.6	2,735–4,514	3.0–4.9	17,936–19,715	19.5–21.5
1927...	11,975	13.8	2,817–4,649	3.2–5.4	14,792–16,624	17.0–19.1
1926...	11,043	13.0	2,815–4,646	3.3–5.5	13,858–15,689	16.3–18.5
1925...	10,754	12.8	2,813–4,643	3.4–5.5	13,567–15,397	16.2–18.4
1924...	7,769	10.2	2,786–4,597	2.7–6.0	10,555–12,366	13.8–16.2
1923...	6,526	8.9	2,785–4,596	3.8–6.3	9,311–11,122	12.7–15.2
1922...	6,101	9.4	2,418–3,991	3.7–6.2	8,519–10,092	13.1–15.6
1921...	4,753	7.8	2,389–3,942	3.9–6.5	7,142– 8,695	11.7–14.2
1920...	6,396	8.9	2,689–4,438	3.8–6.2	9,085–10,834	12.7–15.1
1919...	6,855	10.6	2,301–3,798	3.6–5.9	9,156–10,653	14.2–16.5
1918...	5,220	8.9	2,247–3,709	3.8–6.3	7,467– 8,929	12.7–15.2
1917...	6,085	12.1	1,762–2,908	3.5–5.8	7,847– 8,993	15.6–17.9
1916...	5,441	12.9	1,499–2,474	3.6–5.9	6,940– 7,915	16.5–18.9
1915...	3,491	9.7	1,409–2,325	3.9–6.4	4,900– 5,800	13.5–16.0
1914...	2,687	7.8	1,413–2,332	4.1–6.7	4,100– 5,000	11.8–14.4

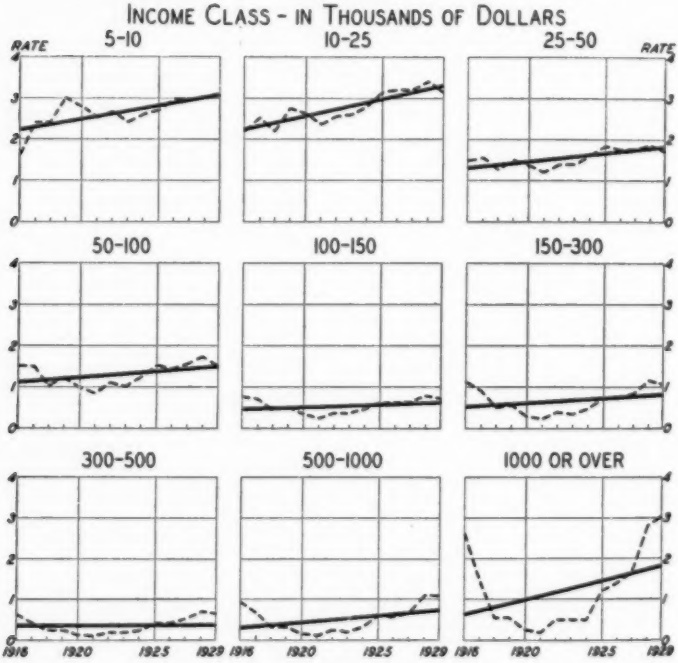
[a] The income data used as a basis for this table (which will be furnished on request) differ slightly from those given by Dr. Warburton in the *Journal* Tables III and IV. They have been adjusted to bring the estimated items for the nine income classes included in the $5,000 or over group, and their sum, into agreement with the total for this group derived independently.

[b] Range data are given here on the basis of two alternate assumptions: (1) that a "negative income" group is included; (2) that the lowest group starts with zero. For 1929, basic data are from *America's Capacity to Consume*, pp. 260, 261, 265. For all other years, savings for the group under $5,000 are computed at an average rate of 5.12 (the weighted average for 1929 if the negative income group is included), and at 8.45 (the 1929 weighted average with the negative income group excluded).

4. A breakdown of the $5,000 or over income group into the nine component income classes considered in Dr. Warburton's article shows an upward trend in the savings ratios for each of these nine classes. Data are presented in Chart IV and Table II for the years 1916–29. Data are not available for a comparable

CHART IV.—UPWARD TRENDS OF SAVINGS RATIOS, 1916–29

(Savings of each class as percentages of aggregate individual income for specified years; with least-square line of trend for each class)



TREND LINES

CLASS (IN THOUSANDS)	END VALUES		ANNUAL INCREASE	CLASS (IN THOUSANDS)	END VALUES		ANNUAL INCREASE	CLASS (IN THOUSANDS)	END VALUES		ANNUAL INCREASE
	1916	1929			1916	1929			1916	1929	
$ 5–$ 10	2.23	3.07	0.065	$ 10–$ 25	2.23	3.31	0.083	$ 25–$ 50	1.31	1.79	0.037
50– 100	1.11	1.47	0.028	100– 150	0.45	0.60	0.011	150– 300	0.52	0.80	0.021
300– 500	0.35	0.36	0.001	500– 1,000	0.32	0.73	0.032	1,000 or over	0.63	1.83	0.092

breakdown for 1914 and 1915—and even for 1916 the basic data are not strictly comparable. For the income classes $100,000–$500,000 this trend is not so pronounced as it is for all other classes. For the $1,000,000 and over class, the 1916 figure probably is out of line because of changes in the method of reporting incomes for tax purposes.

TABLE II. SAVINGS OF THE SEVERAL INCOME CLASSES AS PERCENTAGES OF AGGREGATE INDIVIDUAL INCOME, 1916–29[a]

Income Class	1929	1928	1927	1926	1925	1924	1923
Under $ 5,000[b]	3.03	2.98	3.24	3.31	3.35	2.65	3.80
$ 5,000– 10,000	3.10	2.99	2.94	2.96	2.73	2.60	2.39
10,000– 25,000	3.15	3.40	3.21	3.21	3.18	2.80	2.59
25,000– 50,000	1.73	1.87	1.78	1.74	1.85	1.60	1.40
50,000– 100,000	1.52	1.73	1.55	1.43	1.50	1.22	1.00
100,000– 150,000	.71	.79	.64	.59	.60	.44	.34
150,000– 300,000	1.07	1.15	.84	.72	.74	.46	.33
300,000– 500,000	.66	.70	.49	.40	.41	.22	.17
500,000– 1,000,000	1.09	1.10	.67	.58	.61	.32	.20
Over – 1,000,000	3.04	2.81	1.65	1.38	1.21	.49	.50
Total	19.10	19.52	17.01	16.32	16.18	12.80	12.72

Income Class	1922	1921	1920	1919	1918	1917	1916
Under $ 5,000	3.72	3.91	3.75	3.55	3.83	3.50	3.56
$ 5,000– 10,000	2.66	2.53	2.79	2.99	2.40	2.40	1.62
10,000– 25,000	2.58	2.37	2.63	2.77	2.20	2.52	2.20
25,000– 50,000	1.40	1.20	1.37	1.40	1.26	1.57	1.48
50,000– 100,000	1.08	.83	.98	1.21	1.02	1.49	1.51
100,000– 150,000	.35	.23	.32	.49	.42	.70	.75
150,000– 300,000	.38	.22	.28	.53	.48	.89	1.12
300,000– 500,000	.18	.10	.12	.24	.25	.42	.64
500,000– 1,000,000	.25	.11	.17	.31	.31	.66	.94
Over – 1,000,000	.51	.19	.25	.56	.55	1.46	2.64
Total	13.11	11.69	12.66	14.14	12.72	15.61	16.46

[a] Based on, *Statistics of Income*, 1929, p. 33, *America's Capacity to Consume*, pp. 229, 260, 261, 265. From the *Statistics of Income*, a percentage distribution was made of total income for the several income classes comprising the $5,000 or over group. Conversion ratios (computed as the quotient of Leven's 1929 distribution divided by the *Statistics of Income* 1929 distribution) were then applied to the several years to make the distributions comparable with that for 1929. The resulting distributions of the "$5,000 or over" totals having been adjusted to make their respective totals equal 100, were then converted to percentage distributions of the aggregate of individual incomes for the respective years (conversion ratios being supplied by Table I, column 3, above).

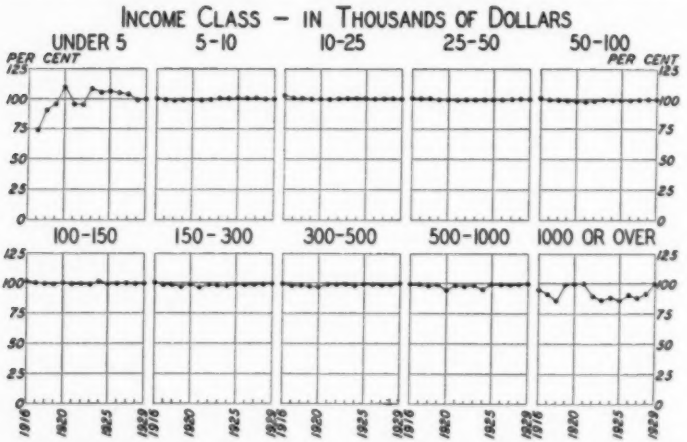
[b] For the class under $5,000 the percentages are the lower range figure for each year, Table II, column 4. If the upper range percentage is used for this class, a change in the "percentage of aggregate income saved by all classes" is involved, but no change in the rest of the items.

5. For the period 1916–29, remarkable stability is shown in the average income received (per capita) by income recipients in every class except the one below $5,000 and the "$1,000,000 and

over" class.[3] Data are presented in Chart V. This information throws light on Dr. Warburton's hypothetical conclusion (in his critical footnote to chapter ix) that the "increase between 1910 and 1918 in the number of families with incomes over $5,000 .... may have been due to the raising of a considerable number of incomes from a little below to a little above $5,000," and that this

CHART V.—THE STABILITY OF AVERAGE INCOMES, 1916–29*

(Average for specified year and class as percentage of corresponding 1929 average)



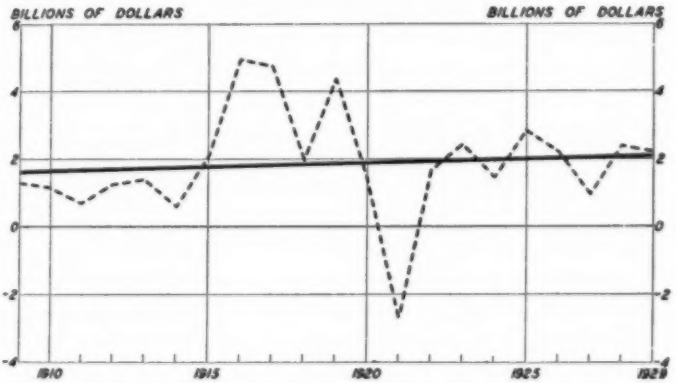
* Computed from *Statistics of Income*, 1929, pp. 32–33. Each percentage given here was computed as a quotient of two ratios: the numerator is the ratio of net income in a given class and year to 1929 net income for that class. The denominator is the ratio of the number of individual returns in the same class and year to the corresponding number in 1929. Dollar equivalents may be computed by applying the ratios given here to the 1929 averages for the respective income classes—*America's Capacity to Consume*, Appendix B, pp. 260, 261, 265.

increase is, therefore, of relatively little significance regarding the trend of savings. While figures cannot be given for the years 1910–15, the stability of the average for the $5,000–$10,000 class during the years 1916–29 argues strongly against Dr. Warburton's contention. (Additional information on the rate of savings in 1910 is given in Section II below.)

[3] These exceptions are probably to be explained by errors in the data. In general, the data used for these computations are from the *Statistics of Income* and are subject to certain errors because of the nature of the data and the statutory changes from time to time that affect their comparability. All income figures for the class below $5,000 are computed as residuals, and therefore are even less reliable than figures for any other class. See discussion in Section III below.

6. Corporate savings (in absolute terms) show wide fluctuations over the period 1909–29. Their trend as shown by a fitted least-square line is up, despite the unusually large amounts allocated to surplus as a result of war-time expansion in 1916, 1917, and 1919—in part offset by losses and a depletion of surplus in 1921. Data are presented in Chart VI. A consideration of this chart is of importance in connection with the summary statements below.

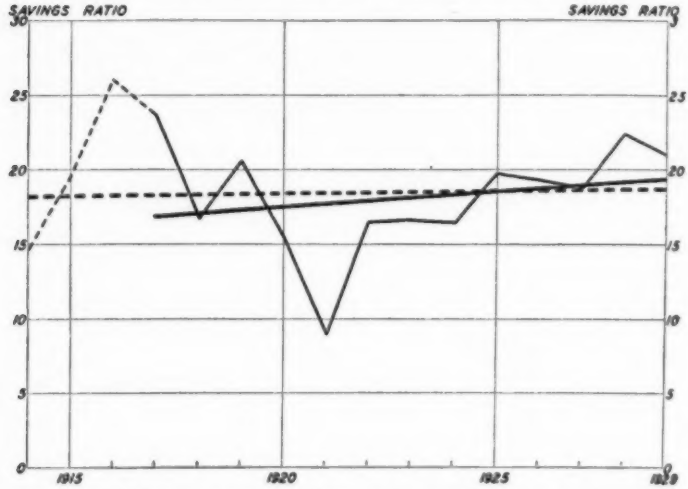
CHART VI.—TREND OF CORPORATE SAVINGS, 1909–29
(Data are from *America's Capacity to Consume*, p. 153)



Trend Line: First Point, 1.634; Last Point, 2.124; Annual Increase, 0.025.

7. Finally, Dr. Warburton's own figures for the period 1917–29 show a decided upward trend in the savings ratios for individuals and corporations taken together—this being the period for which reasonably comparable data may be obtained from the *Statistics of Income*. Even if the three years 1914–16 are included, the line of trend is still upward, though only slightly so. His data are given in Chart VII—with fitted lines of trend. Now, as we clearly show in the section below, there is a biased error in all of the annual ratios he computes. If this error were corrected, the ratios for earlier years would be revised *downward*. A least-square line of trend fitted to the corrected ratios would thus be much more sharply upward than is indicated in Chart VII.

CHART VII.—RISE IN THE PERCENTAGE OF AGGREGATE INCOME SAVED
(Data, which include both individual and corporate savings, are mid-points from last column of Table VII, this *Journal*, XLIII, p. 92)



——— Trend Line, 1917–29: 1917 Value, 16.81; 1929 Value, 19.45; Annual Increase, 0.22.
- - - - - Trend Line, 1914–29: 1914 Value, 18.18; 1929 Value, 18.78; Annual Increase, 0.04.

Lest the savings ratios offered above in charts and tables be accepted as furnishing precise measures of the trend of savings, it should be *repeated* that they are subject to fallacies of assumption and method.[11] This warning will be explained in the section which follows.

II. THE RATE OF SAVINGS IN 1910

In this section Dr. Warburton's computations of rates of savings for 1910 are examined. Here the basic fallacy in his assumptions and methods—referred to a number of times above—is clearly indicated. Since all of his computations of annual rates are affected by this same fallacy, it will be seen that significant errors are thus introduced into all of his results and conclusions.

His estimates of the rate of savings in 1910 are presented in text and table form on pages 92–95 of the *Journal*. These estimates he calculated first by applying the estimated percentages

of income saved in 1929 to the 1910 aggregates of income *for the various classes*. By this computation he showed that in 1910 individual savings amounted to 12.4 per cent of the aggregate income of individuals, and that individual and corporate savings combined amounted to 15.6 per cent of aggregate income. He made a second computation with these rates "stepped up" on the assumption (proposed in *America's Capacity to Consume*) that, because of changes in the price level, an income of $5,000 in 1910 was the equivalent of an $8,000 income in 1929, and that corresponding increases would be found in the savings of 1910 as compared with 1929—similar adjustments being made for all of *the various income groups*. On the basis of "income equivalent" rates of savings—computed for *the various income groups* in line with this assumption—it is indicated in his article that the rate of savings for individuals in 1910 was 14.4; and for individuals and corporations combined, was 17.4.

When his figures, obtained by these two methods, are compared with the corresponding figures of 13.1 and 14.6 for the year 1914,[4] savings in 1910 appear to have been at a definitely higher rate than in 1914. The figures would seem to show this, despite the shift from lower to upper income brackets that was in process—pointed out in *America's Capacity to Consume* (p. 105), particularly with reference to the years 1910 and 1918. What explanation exists for this apparent anomaly?[5]

It will be recalled that in the computations given in the article—and also in Section II above—it was assumed that there were no changes from year to year in the proportion of income saved by those in *the various income classes*. This assumption, as was indicated above, is rightly attributed to "Moulton and Leven" (the *Journal*, page 90). The particular interpretation placed upon it in the *Journal* article is, however, the interpretation of Warbur-

[4] These are the mid-points of the range-data presented in the last column of Table II, p. 537 above, and the last column of Table VI, p. 92, of the *Journal*.

[5] It should be of interest to note that, as pointed out in *America's Capacity to Consume*, no great precision can be ascribed to any comparison between King's estimates for 1910 and those given for 1929. The difference in the basic data available for estimates for the two dates is alone sufficient to account for wide discrepancies.

ton. For example, he interprets this assumption to mean that an average rate of savings computed from 1929 data for the 0–$5,000 class is directly applicable for computing 1910 savings for the same group. He is not troubled by the fact that in 1929 a little more than 60 per cent of aggregate individual income was received by this income class; as against 82.6 per cent in 1910. On a moment's thought it will be seen that if this assumption is extended far enough, the question of "the trend of savings" solves itself—one broad class, one unchanging rate. Here is an assumption whose application requires consideration.

In applying the 1929 savings ratios to 1910 income data, Dr. Warburton groups the data into ten broad classes (with limits at 0, $5,000, $10,000, $25,000, ... , "over $1,000,000"), although savings ratios for 28 (narrower) income classes are available from data given in *America's Capacity to Consume* (pages 260, 261, and 265). This grouping of the data into ten broad classes was also followed in his computations for 1914–29. No question was raised by him concerning known shifts in the relative numbers of income recipients in the several classes, and the way in which such shifts would affect the accuracy of his results.

He uses even broader income classes when he computes the "income equivalent" rates (based on 1929 data) that are applied to 1910 income data to get savings figures adjusted for changes in the price level. While these rates are computed, as before, from data for ten 1929 income classes, the classes are broader: 0–$8,000, $8,000–$16,000, $16,000–$40,000, ...

No indication is given in the *Journal* article that the term "the various income classes" has pertinence to the question in hand *only if interpreted to mean classes that are considerably narrower than those actually used—narrow enough to take account of shifts in the distribution of income.* It is in this sense only that the assumption of the "same savings rates" for "the various income classes" in the several years can be attributed to the authors of chapter ix of *America's Capacity to Consume.* The question involved is, of course, the elementary question of the use of weighted averages.

To illustrate, the rate of savings in 1929 for families and unattached individuals in the 0–$5,000 income class was 8.5. Ob-

viously this is in effect a weighted average of the rates of savings of the subgroups making up the 0–$5,000 class: About 19 per cent of the total income of the group was received by those with incomes ranging 0–$1,250 where the average rate of savings was −5.4; about 43 per cent was received by those with incomes of $1,250–$2,500, for whom the rate of savings was 7.9; 24 per cent was received by the subclass $2,500–$3,750, with a savings rate of 14.7; and 14 per cent by the subclass $3,750–$5,000, with a savings rate of 18.1. Now, in 1910, the income of the 0–$5,000 class was distributed among these respective subclasses in the following proportions: 69 per cent; 22 per cent; 6 per cent; and 3 per cent. If these percentages are applied as weights to the 1929 rates subclass by subclass, the resulting average rate (applicable to 1910) is −0.6. It is apparent that the 1929 rate for the 0–$5,000 class cannot be applied for computing the savings of the same class in 1910. Shifts in the distribution of income within the class have changed the weights with which the rates for the component subclasses enter the average for the class as a whole.

To indicate the effect of narrowing the "various" income and savings classes, computations are presented in Table III. These show savings for 1910 at 1929 rates and at "income equivalent" rates, the essential difference between this table and Table VII from the *Journal* (page 93) being that here the 1910 income class 0–$5,000 is broken into four component classes with limits at 0, $1,250, $2,500, $3,750, and $5,000. The results are of the sort that one might expect. The narrowing of the classes on which the computations are based appreciably lowers the *average* rate of savings for all classes combined. This is indicated below, where the savings rates for 1910 as computed by Dr. Warburton (*Journal*, Table VII, page 93)[6] are compared with the rates derived in

[6] The spread between the two columns of ratios given here does not show the full extent of the correction obtained by breaking the 0–$5,000 income class into four narrower classes. (See footnotes *c* and *d* of Table III, p. 545 below.) For the single year 1910, Dr. Warburton has employed a questionable device whereby he obtains ratios that are about 1.5 to 2 points lower than the results his methodology would produce if this adjustment were not made. This must be kept in mind in considering his ratios for other years which are subject to the full upward bias of his methodology.

Reference to Dr. Warburton's figures shows the aggregate of 1910 income (total

our Table III, in which—to repeat—the 0–$5,000 class has been broken into four narrower classes.

	Warburton Computation	"Narrower Class" Computation
1910 rate of (individual) savings, based on:		
1929 rates for "various income classes"	12.4	6.3
"Income equivalent" rates	14.4	12.2
1910 rate of (individual plus corporate) savings, based on:		
1929 rates "for various income classes"	15.6	9.8
"Income equivalent" rates	17.4	15.4

The rates computed in Table III, and reproduced above, are presented for illustrative purposes only. They roughly indicate the error in Dr. Warburton's computations, but not the full extent of the error.[7] They are in no sense to be taken as actual measures of the rate of savings in 1910. A comparison of the classes used in Table III with those presented in *America's Capacity to Consume* (pages 261, 262, and 265, for example) indicates further possible break-downs in the broad classes employed in the compu-

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for his column 1) taken account of in his computation of the aggregate amount saved in 1910, was $24,330 million. However, in computing the *rate* of savings for 1910, he does not use this figure as a denominator but uses $31,782 million ($30,631 million representing individual income, $1,151 million representing corporate savings) forgetting that the ratio is in effect a weighted average whose denominator should be the sum of the weights used in the computation of its numerator.

The difference between the "aggregate individual income" figure used in the denominator and that used for deriving the numerator is $6,301 million. His explanation for omitting this figure in the computation of aggregate savings (p. 94) is that it represents the aggregate income of individuals below the $1,400 income level, and that "the savings of unattached individuals with incomes below this amount was approximately zero." His savings data (*America's Capacity to Consume*, pp. 261, 262, 265), actually give a savings ratio of −1.8 for unattached individuals in this class; and a rate of −4.4 for families in the same class. Since he reduced the aggregate income for 1910 by $6,301 million (the income of unattached individuals in this class) consistency would require a further reduction of $12,880 million (the 1910 aggregate income of families in this class)—obviously an absurd adjustment.

[7] Had he applied exactly the same methodology for his 1910 computation as for other years, his 1910 ratios would be increased as follows: the 12.4 would become 13.9; 14.4 would become 16.1; 15.6 would become 17.0; and 17.4 would become 19.2. (See Table III below, footnotes *c* and *d*.) Had our computations been made for a greater number of classes (and narrower classes) the ratios we obtained would be somewhat lower.

tations of the *Journal* article—with accompanying downward revisions in the estimated savings ratios for 1910.

TABLE III. ILLUSTRATIVE COMPUTATION OF RATES OF SAVING IN 1910[a]

(For comparison with Table VII from the *Journal* (page 93) to indicate effect of computing from more and narrower classes)

Income Class	Aggregate Income, 1910 (In Millions of Dollars)[b]	1910 Savings, at 1929 Rates		1910 Savings, at "Income Equivalent" Rates	
		1929 Rates[c]	1910 Savings (In Millions of Dollars)	Income Equivalent Rates[d]	1910 Savings (In Millions of Dollars)
$ 0–$ 1,250	$17,465	− 5.4	$−943	1.4	$207
1,250– 2,500	5,518	7.9	436	13.6	750
2,500– 3,750	1,458	14.7	214	19.4	283
3,750– 5,000	786	18.1	142	23.5	185
5,000– 10,000	1,287	23.9	308	32.4	417
10,000– 25,000	1,257	36.3	456	38.6	485
25,000– 50,000	956	40.1	383	43.0	411
50,000– 100,000	794	44.3	352	47.8	380
100,000– 150,000	196	48.6	95	49.6	97
150,000– 300,000	211	51.6	109	54.1	114
300,000– 500,000	31	55.3	17	58.2	18
500,000– 1,000,000	79	58.6	46	61.0[e]	48
1,000,000 or over	491	65.5	322	67.0[e]	329
Aggregate income and savings, and 1910 rates of savings	$30,529[f]	6.3	$1,937	12.2	$3,724
Corporate savings	1,151	.....	1,151	.....	1,151
Individual plus corporate savings, and rates, for 1910	$31,680[g]	9.8	$3,088	15.4	$4,875

[a] For estimating the rates used here interpolates were computed from cumulative data of income and savings, (1) by "straight line" interpolation, (2) by Lagrangian polynomials. The two methods gave practically identical ratios. The rates given here are computed from the straight line interpolates. Data are for families plus unattached individuals (*America's Capacity to Consume*, pp. 229, 260, 261, 265). The slight difference between the rates given here and those used in the *Journal* (Table VII, p. 93) is explained by the omission of unattached individuals from the *Journal* computations of rates.

[b] Computed from W. I. King, *The Wealth and Income of the People of the United States* (Macmillan, 1915), pp. 224–26.

[c] For the group 0–$5,000, the comparable rate is 8.5. If 1910 savings for the 0–$5,000 class were computed at *this* rate, the savings figure would be increased by $2,295 millions and the rates for all classes would be raised from 6.3 to 13.9 and from 9.8 to 17.0.

[d] For the "income equivalent" group 0–$8,000 the comparable rate is 10.4. If 1910 savings for the 0–$5,000 class were computed at *this* rate, $1,109 millions would be added to the total savings figures, and the average rates for all classes would increase from 12.2 to 16.1, and from 15.4 to 19.2.

[e] The rates given here are from the *Journal*, Table VII.

[f] This total (from King) compares with a total of $30,497 million given in the *Journal* (Table I, col. 1), or with $30,631 million (the same, col. 3) or with $24,330 million, the sum of the items given in col. 1, Table VII (p. 93) of the *Journal*.

[g] This compares with the figure of $31,782 million, used as a divisor in the *Journal*, Table VII (last footnote), for obtaining the rates shown there at the bottom of the last two columns.

III. CONCLUSIONS

The foregoing analysis of the rate of savings in 1910 has a bearing on the estimated rates for the years 1914–29 (presented in the article and in Section I above). Throughout this period, a shift was taking place in the proportion of income recipients in the upper brackets. This has been clearly shown by Chart I. Convincing evidence on this point was also presented in *America's Capacity to Consume* in the table on page 102 and the text on pages 101–03. The statistical relevance of that table to the question in hand (if this has been overlooked) is made fully apparent by the analysis of Section II above.

The rate of savings for a given population is, in the nature of the case, a weighted average of the savings rates of its component income classes. The larger the relative numbers of those in the lower income groups, the larger the weight that attaches to the smaller rates of savings (and the smaller the weights attaching to the larger rates), therefore, of course, the smaller is the resulting *average* rate for all groups taken together.

A narrowing of the income and savings classes used in computing the savings rates for the years 1914–28 would change the rates for all years, considerably lowering those for the earlier years. The "trend of savings" over the period would thus have a much sharper *upward* trend than is shown in Charts II and VII. Satisfactory data for computing these annual rates are not available. For the income classes below $5,000, figures from the *Statistics of Income* are admittedly incomplete, and not comparable from year to year.

The estimated income for this large group below the $5,000 level, as given by Dr. Warburton and also in the pages above, is a residual figure, measuring the difference between the sum of the itemized entimates for the classes above this level and the total income for all classes as set forth in *America's Capacity to Consume*. Without a breakdown of these annual residuals, it is impossible to derive reliable savings ratios on the basis of income and savings figures for 1929 and income data from the *Statistics of Income*. It can only be said that available data indicate an appreciable upward trend in savings over the period.

Thus far, no mention has been made of Dr. Warburton's attempts to show that within narrow limits the percentage of aggregate income saved coincides with the percentage derived from the ownership of property for the years 1914–29. Nor have we taken account of his suggestion that consequently an extrapolated trend of savings for the years 1909–14 would closely approximate the percentage of income derived from property. Clearly, the errors of method pointed out in his 1910 computation also affect the rates of savings he has computed for other years. Therefore, any conclusions based upon the precise values of these inaccurate savings ratios—including conclusions based on a purported relationship between them and the percentage of aggregate income received from property—are worthless.

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BERLE AND MEANS ON THE MODERN CORPORATION[1]

FEW books in this century have occasioned a stir in economic and legal circles comparable to that produced by *The Modern Corporation and Private Property*. The stir is warranted, even though some of the fulsome praise showered upon the work by early reviewers may seem now, upon reconsideration, to have been extravagant. Messrs. Berle and Means have joined their very considerable legal and economic talents in a searching statistical inquiry into the facts of modern corporate concentration and an illuminating analysis of the securities markets and of the techniques and practices of corporate control. Their conclusions deal in forthright fashion with the impact of these phenomena upon the economic and social structure of our times and upon the "traditional logic" of property and profits.

Evidence is adduced by the authors to demonstrate the increasing dominance of American industry by the huge corporation—a movement to which at present there is no apparent limit. The corporation has come to be a method of property tenure and a means of organizing economic life—there is a "corporate" system as there once was a "feudal" system. The implications of this development challenge many of the basic assumptions of current thought: it is necessary now to think in terms of immense non-competing business units; the principles (?) of duopoly have become more important than those of free competition; capital is composed increasingly of organizations rather than tangible goods; and economic forces are being supplanted by the conscious activity of a handful of individuals in the governing and control of production. Accompanying and making possible this concentration of economic power is an ever wider dispersion of stock-ownership, bringing in its train a transformation of "ownership" and of "wealth." Through a variety of devices the corporate system has produced as its "logical" and "characteristic" result the twin phenomena of "ownership of wealth without appreciable control" and "control of wealth without appreciable ownership," and thereby has changed the whole nature of profit-seeking enterprise. Wealth has emerged as "passive"

[1] *The Modern Corporation and Private Property*. By Adolph A. Berle, Jr., and Gardiner C. Means. New York: Macmillan Co., 1933. Pp. xiii+396. $3.75.

wealth—liquid, impersonal, and involving no responsibility—and "active" wealth—great functioning organisms depending for their lives upon their security holders, workers, consumers, and "control"; private enterprise has become corporate enterprise; individual initiative has given way to co-operation and the acceptance of authority; the profit motive has disappeared as completely as has the petty tradesman with whom alone it should be associated; and competition has become wholly ineffective as a regulator of industry and profits.

In the concluding book of the volume, a brief twenty-four pages, the authors face the ultimate question raised by these shifting relationships of property and enterprise: In whose interests should the great quasi-public corporations be operated—who should receive the profits of industry? The traditional logic of property would give the profits to the security holders *in toto;* this despite the fact that ownership has been stripped of one of its traditional attributes. The traditional logic of profits would allocate earnings in some equitable (and effective) manner between the ownership and control groups. The logics, thus, conflict, and the authors will have neither of them. The community must demand that the modern corporation serve not alone the owners or the control but all society:

> . . . . It seems almost essential if the corporate system is to survive that the "control" of the great corporations should develop into a purely neutral technocracy, balancing a variety of claims by various groups in the community and assigning to each a portion of the income stream on the basis of public policy rather than private cupidity.

By and large the conclusions offered by the book are well grounded in the evidence, yet the reader is left with the distinct impression that wishfulness has also played its part, and that while the findings throughout are consistent with the supporting data, other conclusions, less sweeping and dramatic, might equally find support therein. Much that is startling in corporate development can be interpreted in terms of "lags and frictions" as realistically as in terms of a "new corporate system." And at the same time it should be noted that while the factual evidence (together with most of the conclusions) runs largely in terms of concentration of control, certain very important conclusions relate to phenomena—imperfect competition, "duopoly," integration, and monopoly—which, while intimately related, are sufficiently distinct to require direct evidence and independent analysis for a convincing case.

The statistical research responsible for the new data on corporation

growth and concentration is praiseworthy both in direction and in thoroughness; it lends solid substance to the renewed awareness which the book creates of the sweep of the modern corporate mechanism. It is to be regretted only that interpretation of this material was not extended to consideration of the differences between significant groups, for such light as might have been thrown thereby on the *causes* and *probable stability of the development.*[2]

To this reviewer the most promising substantive contributions are those evolved in Book II, the successive chapters of which treat of the shifting rights and positions of ownership and control. "Corporation law," say the authors, "becomes in substance a branch of the law of trusts" (p. 275); and the thesis is advanced, applicable to "each and every power in the whole corporate galaxy," that "all powers granted to a corporation or to the management of a corporation, or to any group within the corporation, whether derived from charter or statute or both, are necessarily and at all times exercisable only for the ratable benefit of all the shareholders as their interest appears" (p. 248). The main flow of the argument throughout Book II seems irresistible; the illustrations are pertinent and convincing; the delineation of complicated technical situations and devices is clear; and the reviewer finds himself in accord with most of the value judgments set forth on the host of substantive problems which the authors discuss. This latter comment, however, suggests again the staggering difficulty inherent in lending objective content on any significant scale to the general criterion "ratable benefit of all the shareholders." The inevitable divergence between the interests of stockholders themselves, between their interests and those of the corporation, between their apparent and their more concealed interests, and between their immediate and their remote interests need only be mentioned. While there should be little dissent from the aims which prompt the authors' conceptual extension of the "trust" approach to the law of corporations (despite the absence from the situation of certain characteristics of technical trusts), it is worth while to note that it is of questionable expediency in the field of social policy to strain for concepts and phrases developed in other connections. While useful as instruments of attack, such phrases are also capable of use in other hands as instruments of defense, and while operative at the outset to extend control, they may operate in time as

[2] Cf. W. L. Crum, "On the Alleged Concentration of Economic Power"; G. L. Means, "A Reply"; and W. L. Crum, "A Rejoinder," *American Economic Review*, XXIV (March, 1934), 69, 84, and 87.

an artificial barrier. The judicial history of the "public calling" concept since 1876 will serve to illustrate the point.

It is altogether likely that *The Modern Corporation and Private Property* will be productive of more pronounced and sustained results in the field of law and public policy than in the realm of economic theory. Indeed, there is reason to believe that the effect of the modern corporation on the traditional theory of entrepreneurial profits (which the authors feel has been particularly devastating) has been, in fact, to clarify rather than to destroy. It is by no means clear that the functions of the entrepreneur per se, whether he appeared in the person of the sole owner of a single proprietorship or as one of thousands of common stockholders in a billion-dollar corporation, have ever been properly conceived to be other than to make the final, ultimate decisions inseparably connected with the original commitment of capital to enterprise in anticipation of a non-contractual return and to accept the risk of losing that capital. With rare exceptions, any single stockholder has never been able to exercise formal decisive control over corporate policy, and he has always shared proportionately in profits regardless of the use he chose to make of his fractional control privileges and quite irrespective of any more remote "influence" which he was in a position to exercise. The large modern corporation has, in certain instances and by the use of particular devices, removed even the group of stockholders a step farther away from the firing line of control, but in so doing it has not stripped them of any function peculiarly entrepreneurial in character. Indeed, the very essence of entrepreneurial "control" is its non-delegability—its non-separability from the performance of the function of bearing entrepreneurial risk. And if responsibility, as the necessary concomitant of control, be taken as the test, it does not appear that the mechanism of the new corporation has freed the corporate entrepreneur from any significant economic responsibilities.

It is difficult to pin down with exactness the actual content of "control." To the extent that more of substance is involved than is comprehended in "the making of ultimate decisions," and to the extent that it is formal and definite in character, analysis would suggest that its performance is a function of labor rather than of entrepreneurship. The fact that in many instances the mechanics of wage, salary, or bonus payment has not as yet caught up with the realities of the situation (and has, in some measure, been anticipated by various types of chicanery) is interesting but not germane. To the extent that "control"

is to be understood only as a vague, unpredictable "influence," it must be accepted on the same terms as many other factors and forces in the sphere of enterprise, as very real and important, but simply non-measurable and non-appropriable—in short, non-economic.

One thing seems clear: every significant economic function that has ever been performed within the four walls of the corporation is still being performed within those limits; because of a shifting (or re-defining) of functions and interests, the occasion may be ripe for a reallocation of earnings between the participating groups,[3] but the shifting or "stripping" per se cannot be deemed to give the public any additional claim to a portion of the profit flow. But this is not the whole story; the public claim really rests on much firmer ground. Positive reasons for public control over corporate policy and profits lie in the growth of complexities in the modern economic structure, the appearance all along the line of solid areas of semimonopoly and "administered" prices,[4] and the tremendous power over the lives of all of us—stockholders, laborers, and consumers—which modern corporate development has deposited in the hands of the few at the top. This, rather than any separation of the stockholder from functions previously performed, gives us a basis for purposive and confident action in the premises. To be sure, if clarification of profit theory afforded by analysis of the corporation discloses that the true entrepreneurial function is (and always has been) considerably less important than, mistakenly, we have conceived it to be, then society has little to fear in the way of curtailed initiative from a bold assertion of public authority. But the case for public control is positive; its strength derives from something far beyond the mere realization that the defense against its exercise is weak.

[3] The reviewer is not convinced that there exists an inherent conflict between the traditional logics of property and profits. The traditional logic of property would not seem to compel the conclusion that the full flow of earnings that has traditionally gone to the owning group must continue undiminished and undiverted even though some of the functions formerly performed by persons who were owners have been transferred to another functional group. Note that in their chapter on "The Traditional Logic of Property" the authors themselves say (p. 334), "Insofar as he [the owner] had to pay for the services of other men . . . . in order to accomplish this increase in value [make a profit], these payments operated as deductions; the profit remaining to him was the difference between the added value and the cost of securing these services. *To this difference* . . . . the owner has traditionally been entitled." (Italics mine.)

[4] Cf. G. C. Means, "Industrial Prices and Their Relative Inflexibility," *Senate Document No. 13* (74th Cong., 1st sess., 1935).

The book has caught and treated in most penetrating manner a tremendously important phase in the unfolding of American economic life, but one is impelled to comment upon the inevitability with which the authors, by implication, seem to invest much of the corporate development of the last twenty-five years. It is interesting to speculate on the causal relationship between the concentration of control and the active existence of the various control devices described and analyzed in Book II. It seems clear that the power of the control group rests in substantial measure upon the employment of devices and procedures which, to say the least, are of "questionable" character; and to the extent that the concentration movement may be said to be socially desirable, resort to these tools is a symptom of the embryonic stage of the phenomenon. To the extent that the movement itself may be questioned, it is encouraging to remember that the devices and procedures with which it is implemented are fully amenable to public action. Whatever the inherent force of the movement may be, there can be no gainsaying that the development until very recently has been achieved in an atmosphere of public lethargy—complete unawareness of the problem. And without attempting to predict the course of the future, there can be no denial that a recharged atmosphere that can produce within the space of a few months, drastic regulation of the holding company, an actually operating National Securities Act, a far-flung national code control (constitutionality waived), and studies such as this one, holds the possibility, as well, of a remade corporation.

Fundamentally, the devices of corporate finance in all their fantastic and bewildering array represent, still, to a marked degree the response of legal and financial technicians to the demand of large-scale production for a capital and control mechanism commensurate with its basic needs. That the response has been overgenerous and that much of it is calculated to minister to perversions as well as to basic needs—opening new avenues for the reaping of gains from "maneuvering" as distinct from producing—is obvious; that it could not well have been otherwise is equally clear. Viewed in the light of its inspiration and origin, its rapid and almost frenzied "coming of age" and the combination of indifference and open-mouthed credulity with which, until very recently, it has been received, the whole growth of the corporation and its devices takes on, most convincingly, a "man-made" cast.

Emphasis on the corporation as a mechanism or tool carries the implication that within the limits of practical adjustment we can retain as much of the corporation as seems good to us, and can get rid of the

rest; we can make our own rearrangements, internally and externally; and if the good (e.g., technological efficiency) and the bad (e.g., dangerous concentration of power) in the corporation seem inseparable, we are still free to decide whether the former is worth the price, and to act accordingly.

The possibilities of control and direction through the play of "automatic" economic processes should not be overlooked—it is not without significance that, as the authors point out (p. 177), a giant corporation so organized and administered as to protect important stockholders' rights finds its stock "appreciating for that very reason." But the possibilities extend beyond these forces and beyond the common law of private litigation as we have known it. The wonder is, of course, that the law, grappling with the high-powered corporation of the twentieth century, with the aid, largely, of weapons fashioned ages ago for other purposes, has managed, none the less, in conspicuous instances to point the trend—and this, it may be remarked, without resort to formal recognition of the "public" character of the new organization. Continued advance in this direction is to be anticipated. But this far from exhausts the armory. Federal securities regulation is just now getting under full motion, and the attainment of federal incorporation of corporations doing an interstate business is a distinct possibility. It is difficult to doubt that, once the problems have been uncovered and analyzed and the purposes of control more definitely formulated, our rapidly developing instrumentalities of administrative law, supplementing private suits and competitive processes, will provide a formidable answer to the challenge hurled by the modern corporation. And in disclosing more than we have known to date about the problems, and in sorting and pointing the issues, Berle and Means have hastened the day.

The Modern Corporation and Private Property presents evidence enough that "something can be done." However modest their professions, it is evident that the authors are not to be regarded solely as descriptive painters of the contemporary scene.

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BOOK REVIEWS

VENETIAN SHIPS AND SHIPBUILDERS: A CORRECTION

A misapprehension may have been created by a passage in the very careful and sympathetic review of my *Venetian Ships and Shipbuilders* by Dr. S. H. Thomson.[1] I still maintain that the volume of the international trade of Venice was substantially stable between 1450 and 1560, and that "the Venetian merchant marine *employed in international commerce* appears not to have declined, but actually to have grown in cargo-carrying capacity during the sixteenth century." (Italics mine.) The two figures the comparison of which Dr. Thomson cites as being at variance with the above quotation are not comparable. One of them includes ships under 240 tons, the other does not. For reasons set forth at length in my book I consider that the figures concerning ships of 240 tons or more are those significant for the volume of international commerce. I certainly agree, however, with Dr. Thomson that Venice was not keeping pace with more rapidly expanding western trade centers, and I wished to emphasize, among the reasons why Venice fell behind, the decay of the shipbuilding industry at Venice.

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The Supply and Control of Money in the United States. By LAUCHLIN CURRIE. "Harvard Economic Studies," Vol. XLVII. Cambridge: Harvard University Press, 1934. Pp. xvi+199. $2.50.

This book should have a significant and salutary effect, both on professional opinion, and on college teaching. It attacks, at critically weak points, a dominant and decadent tradition of American thinking on banking questions; and it expounds clearly a set of views which, while firmly established in the "oral tradition" of some schools, are meagerly represented in the accessible literature.

Dr. Currie's general position may be indicated by a sample of quotations:

> The truth is that the whole modern conception of the function of a central bank of controlling the community's money is lacking in the Federal Reserve Act. (P. 88.)

[1] *Journal of Political Economy*, April, 1935, pp. 265–67.

As long as the reserve administration conceives its task as that of the qualitative control of bank assets, the best work of the monetary theorists cannot fructify in actual banking policy, and it is futile to seek to enhance the effectiveness of central bank control over money. (P. 45.)

It may be objected that even though the reserve administration conceives that the primary function of a central bank is to enable member banks to supply at all times and at reasonable rates the needs of their commercial borrowers, there is no great harm in this theory so long as it is so interpreted as to call for an easy money policy in the downswing of business and a restrictive policy in the upswing. It is, however, dangerous to expect adherence to a wrong theory to lead to the adoption of correct policies. (P. 43.)

There is no theoretical justification for the attempt to tie notes to commercial loans, as was done in the Federal Reserve Act. (P. 36.)

If bank assets were confined to commercial loans, which some people think would be the ideal state of affairs, there would be no reason why the decline in loans and the contraction of money should ever cease in the downswing of business. (P. 121.)

The problem of note issue in this country is that of assuring that the changing requirements of the community for notes do not, in themselves, bring about changes in the total volume of money. (P. 110.)

If it is desired to impose a check upon central banks, it would appear to be much more desirable to base reserve requirements on something they can control. In any case there is no good reason for requiring a much *higher* gold reserve against notes than against demand deposits. They should, at the least, be equal. (P. 111.)

The study reflects a rare combination of penetrating theoretical insights and patient competence in the analysis of banking statistics. The highly realistic treatment will make the author's argument convincing, or at least disturbing, to many readers who would be unimpressed by "mere theory." For critical students, however, Dr. Currie's inductive verifications will be largely gratuitous—although everyone will be grateful for the excellent statistical compilation and analysis. In general, the author's fundamental insights are so sound that failure of statistical confirmation would only indicate error or inadequacy in the statistics.

On several crucial points, however, Dr. Currie's position is, to the reviewer, highly unsatisfactory. He contends that only actually circulating media should be regarded as money. "If we include with means of payment all factors which contribute to economy of means of payment," he says (p. 18), "it is difficult to see where we should stop, and the concept of money would become so broad as to be useless."

For quantitative study, of course, a line must be drawn somewhere; the author's distinction is both convenient and sound as a basis for his statistical analysis; but, carried over uncritically into discussion of matters of policy, it reveals an uninspired preoccupation with simple quantity theory and a tendency toward almost fallacious simplification of problems. In particular, the author's definitional reflections seem to account for his notion that changes in the volume of savings deposits, and possible conversions of demand deposits into the savings form, are of minor importance for central-bank policy.

More striking is the fact that Currie's narrow definition of money seems to explain his characterizing as ideal (chap. xv) a system which would represent only a small first step toward an ideal financial structure. The reviewer, while sharing the author's enthusiasm for abolition of banking on the fractional-reserve basis, is impressed with the probability that the fundamental faults of the present system would soon reappear (as with the development of checking accounts, after the strict limitations upon note issue), if reform were undertaken according to Currie's prescriptions. To argue that the functions of commercial banks might be assumed without much disturbance by savings banks, amounts almost to recommending drastic changes on the grounds that their intended effects would never be realized.

At all events, it seems likely that we shall make substantial progress toward understanding of monetary problems, and toward wise proposals for reform, only by facing squarely the task of working with that concept of money which Currie describes as "so broad as to be useless." We realize now that the currency problem has been swallowed up in the problem of commercial banking; but we must go further. We must see that there is little significant difference between demand deposits and savings accounts, and that all institutional borrowing and lending at short term presents the same problems and anomalies as does deposit banking. The criterion of "effective circulation," like legal tender and "general acceptability," must not be taken too seriously.

The effort to discuss banking policy, while only skirting and touching casually upon monetary problems, is not conducive to elegance or clarity. The book, in spite of its title, and in spite of its central thesis, deals almost exclusively with banking. There are a few remarks about the gold standard; and in many places the author impliedly approves of price-level stabilization. But nowhere does he face the fundamental questions as to the proper objectives or ideal rules of policy. Thus, he leaves himself open to the charge of defining error without defining

truth—of criticizing other people's positions without taking a position himself.

Finally one note of emphatic dissent. Dr. Currie evidently is guided (against all experience, one might say) by a faith in monetary dictators—in authorities with large discretionary powers. His notions of desirable reforms run largely in terms of means for augmenting the powers of the Reserve Board. Here he has many writers and students on his side. Yet one may insist that the position is questionable empirically and, above all, that it is simply incompatible with a liberal, democratic faith. Managed currency without definite, stable, legislative rules is one of the most dangerous forms of "planning." A free enterprise economy can function only within a legal framework of rules; and no part of that framework is more important than the rules which define the monetary system. In the past those rules have been empty and inadequate; but there is no tolerable solution to be found in resort to the wisdom of "authorities." No liberal can contemplate with equanimity the prospect of an economy in which every investment and business venture is largely a speculation in the future actions of the Federal Reserve Board.

There is an unpardonable scarcity of punctuation in the volume. Dr. Currie's style is such as to require a generous sprinkling of commas and semicolons; and readers will resent the waste of time involved in rereading sentences repeatedly to discover their structure. While the discussion moves along briskly and concisely in the main, there are numerous protracted digressions on minutiae and elaborate arithmetic illustrations of points that needed only simple statement. With all its faults, however, this book is one of the few economics treatises of recent years which has left the reviewer genuinely grateful and indebted to its author.

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Führer durch die Krisenpolitik (Vol. 6, *Beiträge zur Konjunkturforschung*). By FRITZ MACHLUP. Vienna: Julius Springer, 1934. Pp. xv+232. Rm. 7.80.

This is a brilliant popular exposition of economic policies from the point of view of a Manchesterian doctrine as represented today by what may be called the Neo-Austrian School (and its London subsidiary). Dr. Machlup deals with all sorts of policy-proposals discussed publicly during the crisis but without reference to, or evaluation

of their "importance" for actual policy in any country. Problems of monetary standards, credit expansion, free trade or protection, technological unemployment, manipulation of interest and wages, capital formation, working hours, internal colonization, protection of the middle classes, autarchy and debts, tax-policy and price fixing, etc.—almost every aspect of price-policy (but very few of other types of social control) which is in the foreground of public interest in the last few years, is treated once or several times in the course of fourteen chapters. Nor is the treatment by any means in terms of relevance to the present crisis. Some problems, indeed, such as free trade or protection, are discussed brilliantly but almost without regard to the business cycle. For others, the cyclical aspect is emphasized, but the long-run consideration by far prevails.

A rich variety of interesting issues and insights is offered with a logically consistent attempt running through the book to solve the problems in the "liberal" sense. Amazing, however, is the neglect of the time element in all major considerations. The author supports his orthodox views on monetary matters, for instance, by arguing (pp. 6, 11, 14, 140, etc.) that "inflationary" methods do not help *in the long run*. Obviously, the temporary effects of a moderate credit expansion in the depression ought to be discussed, before dismissing monetary management altogether. Even schemes for raising the velocity of monetary circulation, given Dr. Machlup's view, *sub specie aeternitatis*, must be regarded as just as objectionable as other "inflationary" attempts (pp. 25, 143). Unfortunately for the reader, the author does not raise the further question, whether the rise of velocity (and also of volume) of money which follows every upturn of trade has or has not effects similar to the "inflationary" procedures proper. Orthodoxy has been rarely carried through, under modern conditions, more consistently.

Dr. Machlup's panacea for the depression consists practically in lowering real wages and raising the volume of savings (chap. v). Reduction of (nominal) wages is, of course, unobjectionable in so far as wages are the rigid element in the depressed structure. But no such qualification seems to occur in the present book which takes it implicitly for granted that the demand for labor is as elastic in the short-run as in the long-run. Its main argument that other policies than cost reduction lead to new maldistribution of resources, and therefore to a new crisis, might as well be used against its own wage-lowering proposition. If interference with business, direct or indirect,

leads the entrepreneur to wrong investments, why should wage reduction alone be safe from any such danger? The interpretation of the cycle as due to mal-allocation of resources involves the author in an unnecessary bias for the entrepreneur: capital allocation appears as good when it contributes to the "lengthening" of the production process (p. 165), and as wrong when it is directed to supply for immediate consumption. Of course, this implies a curious use of the concept of "productivity" alternately in the physical and in the pecuniary sense (cf., e.g., pp. 18 and 165).

Very few concrete illustrations are offered, and practically all of them refer to Austria. However, Dr. Machlup succeeded in presenting his overwhelmingly abstract reasonings with a clarity of expression and in a harmonious style which make the book most pleasant reading for both the layman and the economist. His book analyzes and refutes in an illuminating popular form a great many current economic fallacies of the inflationist, nationalist, and socialist type.

MELCHIOR PALYI

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Nuova collana di economisti stranieri e Italiani. Edited by G. BOTTAI and C. ARENA. Turin: Unione Tipografico-Editrice Torinese. Vol. VII, *Organizzazione industriale.* Edited by G. MASCI. Pp. 958. 1934. Vol. XII, *Politica ed economia.* Edited by R. MICHELS. Pp. xli+308. 1934.

The bulky seventh volume in this series, of which earlier volumes have been discussed by the present reviewer in the pages of this *Journal* and elsewhere, is taken up mainly by a translation, apparently unabridged, of Marshall's *Industry and Trade*, and by a translation—also apparently unabridged—of Liefmann's *Cartels, Concerns, and Trusts.* Less than a hundred pages are left for the two Italian contributions which are included. One of these, the essay by Enrico Barone on "Cartels and Trusts," is already available in French, having been originally published in that language in the *Révue de métaphysique et morale* for 1921.

This leaves for special comment in a review intended primarily to call attention to contributions not available as yet in any language other than Italian only the essay by Professor Masci on "Some Current Aspects of Industrial Organization and Industrial Transformations." An earlier book by Professor Masci on *The Laws of Industrial Trans-*

formations (*Le leggi delle Trasformazioni Industriali*, Perugia, 1922) represented an important link in the chain of discussion, inaugurated by the late Professor Supino and continued by Professor Fraccacreta, on a subject which, aside from suggestive remarks by Walter Bagehot, has up to now remained almost an Italian specialty: namely, the mobility or "transferability" of capital. Professor Masci has here condensed some of his earlier utterances on this subject and has made an attempt, welcome even though it is only a very rudimentary one, to bring certain of the issues involved into relationship with some of the findings of the most recent monetary theory (pp. 936 f., 942). On the other hand, the author might well have omitted the pages (934 f., 938 f.) in which, with an emphasis undeserved by his subject, he attempts to bring his discussion of the problems of industrial organization into relation with "the profound originality" (p. 939) of Fascist economic policy.

Professor Michels presents his volume on *Politics and Economics* (Vol. XII in the series) as typical of the interests of those who would "overcome the abstraction of economics by putting it in direct relation with politics and philosophy" (p. x). To this end, he includes, as representing the Marxian "synthesis," the *Communist Manifesto*, in a very much revised Italian translation (p. xxii); and he surrounds this with contributions from three "great Italian writers" who interpreted, developed, or opposed the Marxian doctrine. Thus, we have Antonio Labriola's "In Memory of the Communist Manifesto," Achille Loria's "The Economic Synthesis," and Pareto's "Preface" to the first volume of Marx's *Capital*. All three have appeared in some language other than Italian and therefore need not be commented upon here. (Labriola's paper was published in the volume entitled *Essays on the Materialistic Conception of History, by Antonio Labriola*, 1904. An English translation of Loria's *The Economic Synthesis*, of which the present Italian version is an abridgment, was published in 1914. Pareto's "Preface" was published originally in French.) The rest of the volume bears more direct testimony to the fact—if memory serves me—that this volume was originally to be entitled *Sociology*, much to the sharply expressed displeasure of certain eminent Italian economists who questioned the propriety of including a volume on sociology in a series supposedly intended originally to deal only with economics. The frankly sociological sections are made up of a set of chapters from Max Weber's *Wirtschaft und Gesellschaft*, and of chapter vi of Georg Simmel's *Soziologie*.

Professor Michels' Preface of some thirty pages represents the first really notable departure from the practice thus far followed in the series of refusing to attempt to imitate Ferrara's inimitable prefaces to the *Biblioteca dell' Economista*, of which this series is the avowed successor. Yet the mass of bibliographical detail, as well as the biographical notes on Labriola and Weber which Professor Michels provides, will make the Preface welcome to many readers.

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The Estates of Crowland Abbey: A Study in Manorial Organisation. By FRANCES M. PAGE. Cambridge: Cambridge University Press; New York: Macmillan Company, 1934. Pp. xiv+462. $7.50.

While seventeen abbots ruled at Crowland Abbey, faithful scribes recorded the legal and economic vicissitudes of its widely dispersed manorial possessions. Ninety-six court- and account-rolls covering the period from 1258 to 1528 are preserved at Queens' College, Cambridge, and from these documents Miss Page has reconstructed a vivid picture of manorial organization particularly in the three Cambridgeshire manors of Oakington, Dry Drayton, and Cottenham. Walk out the Huntingdon road beyond Girton College and there lie these villages today: Dry Drayton on the left, the other two on the right, greatly changed in outward form and totally transformed in economic structure. English agrarian changes have come to be regarded as a familiar chapter in economic history, but Miss Page's detailed study of these three fenland manors, like Professor Gras's history of Crawley, again warns the economic historian against the danger involved in generalizing about English agricultural history.

None of the three Cambridgeshire manors was a vill and, since some lords were sub-tenants of others, the schoolbook simplicity of manorial organization gives way to a "tangle of liabilities which filled the court-rolls with pleas and the scribes with bitterness." For example, although the Abbot held a charter from Henry III which gave him indisputable rights to recover fugitive villeins from neighboring lords, enforcement was exceedingly difficult leading to real trouble when, by the third quarter of the fourteenth century, flight had become a serious problem. Yet the Crowland rolls reveal co-operation as well

as conflict between lords with contiguous lands in the same vill, and confirm the conclusion "that the isolation and self-sufficiency of the manor are fictions, and that it is essential in any reconstruction of manorial organization to take into account the existence and influence of neighboring powers inside the boundaries of the same township."

Although the economic historian will find much that is illuminating in Miss Page's analysis of the relation between the manor and the national system, and in her clear picture of local government, his chief interest will necessarily center in the chapters which outline the conditions of tenure before 1348, the law of transfer, the Black Death, and the resulting conditions of tenure leading slowly but inevitably to the dissolution of the manor. Before 1348, money rents were paid extensively by free and unfree tenants. Cautiously analyzing "assised rent," Miss Page concludes that it was composed of the usual *redditus ad terminos* plus a second element which must have been commutation of dues in kind. Included in such commutation was the temporary "sale of works" arising from surplus "works" not needed for the cultivation of demesne land and canceled for a monetary requital. These temporary commutations do not appear in the records of "assised rent" until they had "lapsed for an undefined but sufficient length of time in favour of a money equivalent." Thereafter the change was considered permanent and the payments were counted in "assised rent."

The *opera* items in the account-rolls, Miss Page regretfully admits, "show little that is unique or interesting." The heavier work of demesne cultivation was evidently performed by the lord's permanent *famuli*, while the tenants' labor services "consisted merely in helping the hired professional worker." That ordinary tenure was based on cradlehold is attested by a lawsuit but it seems to have been "more honoured in the breach than in the observance." Support of landless brothers and sisters took the form of "allowances" (compulsory grants of small land areas by the heir) but the "allowances" did not relieve the tenant from responsibility for rents and services. That poor relief and land tenure were inseparably merged before 1348 is proven by the limited number of "chevage" payments, but, while this evidence reveals "a strong attempt to remove the root cause of poverty," there is little proof offered to show that it really did.

The scythe of the Black Death cut down thirty-five of the fifty landholders at Oakington, twenty out of the forty-two at Dry Drayton, and thirty-three out of fifty-eight at Cottenham; but, in spite of this

terrifying mortality, the small number of vacant plots indicates the existence of a land-hungry labor reserve willing to take up land on the "ancient" conditions. Moreover, the new stream of entrance fines brought "immense financial gain" to the abbot. It was the existence of this reserve of potential tenants which delayed the emergence of great changes ordinarily ascribed to the Black Death. Contrary to the usual explanation, "there was no distinct change in the direction of money rent"; in fact, the short-time effect was probably a reverse process of calling for the actual labor of tenants whose surplus "works" had previously been commuted temporarily. By 1365, however, new forces were evident. The rolls indicate that repair of houses was neglected, that the number of tenants charged with removal of timber had greatly increased, that straying cattle caused an ever increasing annoyance. Flight from the manor is shown dramatically on the increase (p. 149) and this fact definitely qualifies Miss Page's conclusion (p. 126) that "startling changes" did not occur. It is true that they did not occur immediately, but Miss Page admits (p. 153) that by 1391 shortage of tenants had become a genuine problem. Thus forty years were actually required to produce fundamental change, but a period of forty years was a very short time to alter an institution as static as the English manor.

Only an arrogant reviewer would dare go beyond description when dealing with a book based entirely upon documents which he has not himself examined. But description should be sufficient to indicate the notable contribution to English manorial history which Miss Page has made. Subjoined to 155 pages of text are 289 pages of documentary appendixes, a rich mine for the close student. Here are reproduced selections from charters, agreements, court-rolls, and account-rolls, together with statistical exhibits compiled from the account-rolls which throw new light on rents, crop yields, prices of manorial purchases and wages. "All the original evidence which a student can reasonably want," Professor Clapham has aptly said in his editorial Preface, "has been made accessible" in the appendixes. Let others follow Miss Page's scholarly example; the fruits have abundantly justified and rewarded her labors.

E. A. J. JOHNSON

Cornell University

The Lancashire Cotton Famine, 1861–1865. By W. O. HENDERSON. "University of Manchester Economic History Series, No. IX." Manchester: Manchester University Press, 1934. Pp. xiv+178. 8*s.* 6*d.*

Mr. Henderson gives us here an extract from his wider study of the effect of the American Civil War on the world's cotton industry. He has already described the effect on continental Europe (*Economic History Review*, April, 1933), and thirty-eight pages of bibliography show that he has ranged wide over printed and manuscript sources, official and unofficial, in search of his facts. The result is a work which touches every side of the story—the commercial causes and effects of the famine, the attempts to obtain cotton from non-American sources, the extent and relief of distress, and the sufferings of the operative population. The tale is told without any display of emotion, but is grim nevertheless, especially when we realize that while Lancashire was "down and out" the rest of the country was flourishing and prosperous. The "distressed area" was not an invention of the post-war era; but whereas Lancashire in the sixties aroused the sympathy of the whole white-faced world and received aid even from the British colonies and the northern states of America, it has few practical friends in its distress today.

Mr. Henderson revises the orthodox story of the famine at many points. One of his most interesting conclusions is that distress did not come out of a clear sky. A bumper cotton crop in 1859–1860 gave cheap raw material, while a post-war demand for cottons in India and China gave a temporary boom after the dreary depression of 1856–58. Production and cotton-buying therefore became hectic, but when the Asiatic demand slackened Lancashire was overloaded with raw material and goods. A bad slump was inevitable, but the stoppage of cotton exports from the South allowed manufacturers and traders to clear off their stocks at high prices. To be caught burdened with goods was a godsend and, while workmen starved, the lucky employers and merchants made fortunes.

The book belongs to the Manchester University Economic History Series, begun so auspiciously by the late Professor George Unwin. In it, as in its predecessors, Unwin's spirit goes marching on.

HERBERT HEATON

University of Minnesota

Maryland Business Corporations, 1783–1852. By JOSEPH G. BLANDI. "Johns Hopkins University Studies in Historical and Political Science." Baltimore: The Johns Hopkins Press, 1934. Pp. 116. $1.25.

This monograph is one of a series on the early history of corporations. All of the charters granted by special act of the Maryland legislature between 1783, when the Susquehanna Canal Company (the first corporation in Maryland and the first canal company to be incorporated in the United States) received its charter, and the passage of the general incorporation act of 1852, are surveyed. The scope of the work is indicated by the chapter headings: Introduction, Size and Importance, Capital Structure, Liability, Control, Taxation, Conclusions. A complete list of all corporations chartered during these years is given in the Appendix.

It is interesting to note that the development of corporate practice in Maryland was influenced by the fact that the State was a stockholder in some corporations and a potential stockholder in others. For instance, double liability on bank stock developed late in Maryland because the legislature did not care to subject the State to double liability on its stock ownership in the commercial banks. The State of Maryland, in sharp contrast to the better-known instances of Illinois and Mississippi, found the ownership of bank stock a profitable investment.

This monograph is quite obviously the result of careful, painstaking work, and scholars working in the fields of economic history, corporation history, and local history, will find it useful. The comparison and contrasts which will be possible when the promised studies of other states are available will no doubt throw new light on the early history of corporations. In spite, however, of the many merits of this study, the reviewer is disappointed because of the lack of information concerning the political aspects of these early charters. There is no discussion of the influence of special interests and other pressure groups. A reader gets the impression that, on the whole, there was much less corruption, graft, and mismanagement in the early Maryland corporations (and legislature) than in other states. In fact, one is given the impression that the corporation situation in Maryland was thoroughly satisfactory. Yet, in 1852, a general incorporation act was passed, a fact which the author makes no attempt to explain.

HARRY L. SEVERSON

University of Chicago

The Use and Abuse of Statistics: With Special Reference to Australian Economic Statistics. By F. R. E. MAULDON. Melbourne: Melbourne University Commerce Students' Society, 1933. Pp. 52. 1s.

All but the last chapter of this little introduction to Australian economic statistics consists of matter originally delivered over the air in a series of radio talks. Unpromising a vehicle as the radio may seem for such a topic, Dr. Mauldon's enterprise is to be commended; and it is not unlikely that his voice reached a wider circle than those unacquainted with Australian conditions—and especially Australian methods of wage-regulation—might be prone to imagine. Nevertheless, the circumstances in which the material was prepared have left their mark, and the book remains a very elementary introduction to a complex subject. As such, however, and especially by reason of its skilful blending of the history and methods of statistics, and Australian statistical sources, it will be found very useful to Australian students and perhaps equally so to foreigners endeavoring to obtain a bird's-eye view of Australian statistical resources. Incidentally, it may be mentioned that strenuous efforts are at present being made by the official statistical bureaus to fill some of the gaps catalogued by Dr. Mauldon, especially in the field of price and employment statistics.

A few inaccuracies have been noted. On page 29 it is stated that the recorded values of Tasmanian exports have for some years been double the values actually received. This appears, unfortunately, to be true of exports of *apples*, but it is certainly untrue of all Tasmanian exports. On page 32 it is stated that the war census of wealth and income in 1915 ". . . . is the only instance of a country ever having taken a direct census of incomes." Data on incomes were collected in the New Zealand Census of 1931 and again in the Australian Census of 1933. On page 34 it is stated that we have no later estimate of the private wealth of Australia than that for 1925. Estimates for 1927 were published in the eighteenth issue of the *Pocket Compendium of Australian Statistics*, and for 1929 in the nineteenth issue, both of which should have been available to the author at the time of writing. The 1929 estimate was later given in greater detail in *Commonwealth Year Book*, No. 26. In the table of wheat prices on page 15 the author has inadvertently given an inaccurate source reference, and has omitted to state the currency unit in which the prices are expressed. It happens to be pence per bushel.

The last chapter contains a very cursory account of the influence of

statistics on the development of economic thought in the United States. There is no index, but useful footnote references have been appended to some of the chapters.

ROLAND WILSON

Canberra, F.C.T., Australia

Labor Problems in American Industry. By CARROLL R. DAUGHERTY. Boston: Houghton Mifflin Co., 1933. Pp. xviii+959. $3.50.

The mixed feelings left with one after perusal of the majority of new texts in the labor field are probably imputable more to the difficulties inherent in handling the subject-matter than to legitimate grievances against the work of the authors. The ramifications of the various "problems" are so numerous, the undigested raw material so voluminous, the rendering of occasional personal judgments so inescapable, that maintenance throughout of the standard attained in the best portions of a general labor treatise would probably be more of an achievement than one could reasonably expect.

Of the merits of the book prompting these observations there can be little question. Dr. Daugherty has covered thoroughly the documentary and other material that has accumulated with bewildering rapidity of late; he has interwoven economic theory and the "problems" more successfully than have the writers of other recent introductory labor books; and he has handled the statistical material in a manner conducive to giving the student a wholesome respect for the quantitative method and at the same time making him statistically wary. The style is easy and mature. In organization the book is (with a few minor exceptions) conventional: an introductory part, including a summary story of the evolution of the wage system and a dose of industrial psychology; a division dealing with the various forms of economic insecurity, wages and incomes, hours, sub-standard workers, and industrial conflict; and a section devoted to attempted solutions of the problems on the part of organized labor, employers, and the state.

Questions of emphasis, content and interpretation inevitably arise. The early chapter on "Psychological Aspects" is one we have come, of recent years, to expect in labor texts. In the opinion of the reviewer it adds little; the treatment necessarily has to be too summary, these so-called psychological aspects must in any case be dealt with in connection with the problems and their attempted solutions, and successful integration of this material with what comes later is extremely

difficult. The wages and incomes chapters include a large amount of well-organized quantitative material, but the theoretical implications of some of the comparisons made in judging the workers' progress—real wages with physical product, value product, etc.—should be developed more fully. Orthodox position on such matters as technological unemployment, reduction of hours, the overproduction thesis, and wage determination is always conscientiously stated, together with an infiltration of skepticism about the assumptions underlying orthodox doctrines. The theoretical parts of the book are not, however, its superior feature. The chapters on unionism are strongest in their treatment of structural aspects and tactics and methods; weakest in historical interpretation, evaluation of the theory of collective bargaining, and explanation of how the common-law principles relating to union objects and methods came to be what they are. There is too little emphasis upon the environmental conditions giving to American unionism its distinctively American characteristics. But, again, questions of emphasis and interpretation are rather inevitable. On the whole Dr. Daugherty's book is, in the opinion of the reviewer, the most satisfactory of its kind published during the last decade.

ROYAL E. MONTGOMERY

Cornell University

Labor, Industry and Government. By MATTHEW WOLL. New York: D. Appleton-Century Co., Inc., 1935. Pp. vi+341. $2.00.

Vice-President Woll of the A. F. of L. describes organized labor's attitudes toward recent changes in the American economy. He begins with a brief, uncritical statement of historic doctrines and policies of the Federation, which is followed by a more extended exposition of that organization's position with respect to collective bargaining, majority rule, the "right" to strike, union incorporation, the labor injunction, wage policies, working hours, the codification of industry, economic planning, monetary inflation, social insurance, foreign trade, international labor movements, and education.

The author's three major theses may be restated briefly as follows: (1) The prime essential to recovery and permanent prosperity is the expansion of labor's purchasing power; (2) The only hope of escaping increasing unemployment in the future lies in continued reductions in working hours; (3) Labor organization is the desirable means to be used in achieving each of these objectives, because the alternative is

extended governmental control, which is likely to lead to compulsory arbitration (pp. 107, 123) and, ultimately, to fascism (p. 199).

The economic philosophy of the author follows well-established trade union precedent. Repeated reference to the necessity for higher wage rates, for instance, notes no relationship between such rates and the demand for labor. Similarly, "The one immediate and infallible remedy [for unemployment], always applicable, is a shortening of the working day or week, or both, without any lowering of the wage" (p. 15). Again, in looking to the future, " . . . . we shall have to choose between employing a relatively small number of persons in industry on the present hours or a larger number on shorter hours" (p. 159). Increases in the physical productivity of industry are considered proper measures for increases in wages (pp. 146, 194). Foreign trade is regarded as of little importance to the United States, and tendencies to encourage foreign competition in domestic markets appear to the author to be hazardous to native living standards.

Chief contributions of the volume include its frank statement of labor's critical attitude toward outside advisers (p. 100), its description of the use of federal labor unions and collective agreements participated in by several trades as substitutes for industrial unionism, its suggestion for the licensing of corporations, and its recognition of the fact that governmental sponsorship of unions is likely to carry with it an assumption of governmental responsibility for their control.

The statement as a whole represents a typical, uncritical exposition of organized labor's economic and political philosophy. The volume is replete with unsubstantiated declarations, one of the most objectionable being that which redefines vertical unionism to limit it to individual plants, thus making it practically identical with company unionism.

DALE YODER

University of Minnesota

Labor Fact Book, I and II. By LABOR RESEARCH ASSOCIATION. New York: International Publishers Co., Inc., Vol. I. 1931. Pp. 222. $2.00. Vol. II. 1934. Pp. 222. $2.00.

These two volumes attempt "to provide a ready arsenal of facts for use in the current struggles" of the working-class movement. The first volume gives a poorly organized assortment of facts and figures on subjects varying from raw materials to injunctions. Much of the data, for example on child labor, were five to ten years old when the volume

was published. Many subjects are omitted, or covered very inadequately even when one judges them as propaganda. Neither volume mentions the sales tax. In the two pages devoted to tariffs their use in "imperial conflicts" is discussed, but not their effect upon the worker's standard of living.

The material is presented with a definite attempt at propaganda, and sometimes the result casts doubt on the accuracy of the title of the volumes. Examples of such information given as facts are: "*Pravda* .... in April 1931, exposed preparations of the Farm Board to help the interventionist plans of the imperialist. It pointed out that the Board had been storing wheat in anticipation of war against the Soviet Union" (vol. I, p. 122); and "The NRA has fixed wages at the low crisis levels .... The countrywide and regional labor boards of conciliation are taking away the right of workers to strike and organize into their own unions" (vol. II, p. 70).

The second volume is superior to the first. It reviews the unpleasant period from 1929 to 1934, with suitable contrast to the progress in the U.S.S.R. References are more frequent and authoritative. The charges against the capitalist system are more documented and less hysterical. Perhaps the reason is that truth provides sufficiently harsh criticism of this era. The section "Workers' Condition in the Crisis," especially the section on housing, pages 85 to 88, is loaded with facts which are often ignored.

This volume should interest those who want a semi-official communist interpretation of the depression. Judged from the point of view of their purpose, the volumes are probably a success.

GEORGE S. WHEELER

University of Chicago

Industrial Labour in India. By S. G. PANANDIKAR. New York: Longmans, Green & Co., 1933. Pp. ii+299.

This study presents a picture of the dislocations caused by the grafting of a western factory system upon an ancient eastern village economy. Although only $5\frac{3}{4}$ per cent of the population of India could be classified as industrial workers in 1931, the aggregate number so engaged—over 20,000,000—furnishes a sufficiently large sample to show the contrast between two ways of life, the one dominated by the caste-bound routine of the village, the other controlled by the unaccustomed discipline of the machine. The habits inculcated by tra-

dition and by agricultural conditions yield stubbornly to the new technique. The Indian industrial workers are "inefficient" judged by western standards; when they are torn from their usual surroundings and regimented in barracks, thinking of their wives and children in distant villages, missing the warm home-cooked meals and the freedom of the open fields, these latest recruits to the factory system suffer both in health and efficiency. This book is valuable for the American economist, not merely because of its realistic description of factory conditions, wages and hours of employment in India, but because it enables him to set these facts against the agricultural background of India, and against the familiar habits fostered in the factory environments of the United States.

HOMER HOYT

Washington, D.C.

High-Level Consumption: Its Behavior; Its Consequences. By WILLIAM H. LOUGH with the assistance of MARTIN R. GAINSBRUGH. New York: McGraw-Hill Book Co., Inc., 1935. Pp. xii+345. $4.00.

Can we find out how American consumers in the aggregate dispose of the national income? Interest in this problem has been quickening in the last few years and, increasingly, there are those with sufficient confidence in their calculations to be willing to publish them. This is the first book known to the reviewer devoted entirely to this problem. Part I and an appendix of a hundred pages present the estimated expenditures for 249 different items grouped into twelve major classes, including direct taxes and savings, for each year the Census of Manufactures was taken from 1909 to 1931. In Part II the estimates are reduced to 1913 dollars by means of a calculated "over-all index of consumers' purchases" and the attempt is made to "discover by statistical analysis the motivation affecting consumption and the behavior of consumers—in the 23-year period studied." Part III supplies forecasts as projections of trends that seem likely to persist.

These authors discuss far more adequately than others who have published similar estimates the sources of their data and the method by which they arrived at their final figures. They use, in the main, production records and make no attempt to estimate the expenditures of the various income classes. They warn the reader that their figures are built-up estimates derived from data assembled from scattered sources, often by a series of steps subject to criticism and revision. One wishes, however, that they had done even more to clarify the methods

by which they arrived at their final figures and the hazards at each step. A step-by-step demonstration of the process of arriving at the estimate for eggs or cotton piece-goods, for example, would have been valuable. In this connection the reviewer finds especially weak the evidence given for the conclusion that the relative costs of distribution of consumers' goods have not changed appreciably during the period under investigation. This may be true, and it may be necessary from lack of adequate data to assume in most cases the same percentage of "spread" between value at the place of production and retail value in the early years as in the later, but to treat this assumption as a major discovery seems unjustified.

The major objectives of this study were, however, analysis and prediction, objectives attained only in a qualified sense in terms of broad trends and for the major classes of goods. The difficulties can be inferred from a statement of the problems to which the authors apply themselves: to measure "the strength and influence of the chief motives which govern spending"; to measure elasticity, dispensability, and variability of demand—that is, its responsiveness, respectively, to changes in price, changes in spending power, and to "temporal changes." The twelve main classes of "consumers' takings," are then rated as to their stability. "Social-cultural" activities, which had the first rating for indispensability and invariability and third for inelasticity, were ranked first for general stability. Food, sickness and death, and personal appearance came next in the order given on the basis of their combined ranking. Transportation, savings and taxes, and home equipment were most unstable in the order given.

HAZEL KYRK

University of Chicago

Municipal Administration. By WILLIAM BENNETT MUNRO. New York: Macmillan Co., 1934. Pp. viii+669. $3.75.

Professor Munro comments in his Preface on the advances in municipal administration during the last ten years which have rendered his previous work on local government obsolete. To meet these changes, he has added chapters on such functions as the abatement of nuisances, airports, housing, the inspection of weights and measures. The bibliographies at the ends of the chapters have been brought up to date; as for the topic of the city clerk, he notes the dearth of material, since no one else has written on this subject.

Mr. Munro is not content to give the student a purely theoretical anatomy of local administration: he is at pains to be realistic in recog-

nizing the presence of partisanship, ward politics, the spoils system, frustrating the best schemes of organization. In fact, at point after point, Mr. Munro is apparently driven to conclude that few, if any, city administrations can be trusted to conduct this or that undertaking or service, because of incompetence or corruption; private enterprise shines by frequent comparison. Bribery of the purchasing agents of private corporations (an evil so widespread as to lead to penal legislation against it in some states) and the awarding of contracts or insurance business to friends of the company president, do not figure in his picture. With this point of view expounded in every chapter, one is surprised not to find any reference to Lincoln Steffens' books in the elaborate bibliographies, nor his name mentioned in the Index. Perhaps the reason is that Steffens is interested in an analysis of forces. Mr. Munro does not seem to be. The reader is told that there is incompetence and corruption; he is given slight hints of the forces working either for or against it.

In fact, despite the bibliographies, Mr. Munro does not seem to be in touch with the forces which have been working for the improvement of municipal administration in the decade since his last book. To pick but one example, in his chapter on "The Merit System," he laments the lack of facilities for in-service training. "But there are no regular summer schools or extension courses for detectives, traffic officers, fire prevention officers, assessors, city clerks . . . . and all the rest" (p. 50). The fact is that under the leadership of state leagues of municipalities, city officials, and universities, hundreds of such courses have been given in many states for a number of years, not only for the very types of officials named, but many others. Indeed, such classes have been held for eight years, reaching hundreds of public employees, in a large city not many miles from Pasadena.

Mr. Munro reports that the city-manager form of government "now operates in more than three hundred cities" (p. 12). It has operated in more than 400 since 1929, and now operates in more than 440. He often begins his chapters with a definition of the function to be discussed. Thus the "lawyer's definition" of a public utility is that it has "special privileges in relation to public property" (p. 635), such as the right of eminent domain, which is shared in some states by cemetery associations. The concept, "affected with a public interest" is not presented. Zoning is defined as the public restriction of land "to certain designated uses or to certain types of structures" (p. 237), although every comprehensive zoning ordinance covers building bulk, and minimum lot-size and coverage.

A chapter on "Housing" is included—one might think as acknowledgment of a new problem of concern to local government. But no; publicly sponsored housing is discussed as a financial loss to the public treasury, which does not reach the people for whom it is intended, and which even in Europe has not made a sizeable dent in the problem. "What is needed, therefore, is a code of well-framed housing regulations which will make it impossible for flimsy, insanitary . . . . houses to be erected in the first instance" (p. 541). Shades of the New York tenement-house law of 1901, which "inaugurated . . . . a new era in legislation with respect to housing" (p. 533).

The student who reads this book will, as Mr. Munro says, be told of more functions of local government than ten years ago; but of the changing forces in the field, of the influence of organizations of public officials, of the impact of the federal government on local government, of the flesh that clothes the skeleton so carefully anatomized, he will gain little feeling.

CHARLES S. ASCHER

Public Administration Clearing House
Chicago

Principles of Money, Credit, and Banking. By ROY L. GARIS. New York: Macmillan Co., 1934. Pp. xxi+1056. $3.50.

This monumental text will fill the needs of those teachers who wish a good summary of the opinions of many other economists on monetary and banking problems. While there is little in the way of theoretical discussion that is new, it does contain much recent historical information which has been painstakingly gathered. It would have been a more finished job if the author, as he endeavored to include recent incidents, could have summarized the documents and statements which he frequently reprints *verbatim*. The tone is conservative throughout. For example, Garis says: "It would seem evident from our discussion that the post-war and present monetary ills of the world have not been caused primarily by the gold standard, but rather by a wholesale abuse of sound, fundamental monetary, and credit principles" (p. 131). If we only knew what these sound or fundamental principles are! As a text, it is well written, has many other good points, and will be widely used. While it was being written, things were happening so rapidly that the author had considerable difficulty in placing recent events in their logical place. The Index in this book is so incomplete that it is almost impossible to use it successfully.

CHARLES S. TIPPETTS

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